Airport Capacity Benchmark Report 2004

U.S. Department of Transportation
Federal Aviation Administration
The MITRE Corporation
Center for Advanced Aviation System Development

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The FAA is delivering on its promise to increase the capacity of the U.S. aviation system. Our five-year strategic map of how to get there, *Flight Plan 2004-2008*, outlines the pledge to make the system run as efficiently as possible. Specifically, we are accelerating the delivery of technology and procedures to boost capacity at America's 35 busiest airports. We have also updated our standardized measurements, providing a better barometer of the steps we are taking to meet our *Flight Plan* goals.

The new version of the Benchmark Report provides information on which factors, such as weather or runway layout, are most important in determining the capacity of our largest airports. Ultimately, this data helps us measure the return on investment for new runways or other technologies designed to increase capacity.

A "capacity benchmark" is the number of departures and arrivals per hour that an airport can handle safely and routinely. Since the first edition of this report was published in 2001, we have refined our methodology to include three rates for each airport. These reflect capacity in three weather conditions:

- ✓ ***Optimum*** represents good weather with visual separation;
- ✓ ***Marginal*** describes weather not good enough for visual approaches, but still better than instrument conditions; and
- ✓ ***IFR*** – instrument flight rules – defined as instrument conditions (ceiling less than 1000 feet or visibility less than 3 miles) when radar is required to separate aircraft.

These benchmarks represent routine operations at the airports and could be exceeded occasionally under favorable conditions. Conversely, lower rates could be expected with less than optimum conditions. For example, a squall or an afternoon rush of departures might trigger a different runway configuration or unavoidable congestion.

The data contained in this report are not only used to determine current and future airport capacity, but to evaluate the benefits from procedural, technological, and runway improvements outlined in the FAA's Operational Evolution Plan, which measures the capacity of the system at key airports across the country.

As we learn more and more about the best ways to make aviation flow more smoothly, the *Airport Capacity Benchmark Report* will help us understand demand as it relates to capacity. This report sets the standard against which we can measure our efforts. I look forward to hearing from you about ways in which we can improve this report and our service to the flying public.

Marion

Marion C. Blakey
Administrator

Introduction and Overview

Purpose and Definition

The Federal Aviation Administration (FAA) has developed capacity benchmarks for 35 of the nation's busiest airports to understand the relationship between airline demand and airport runway capacity. They are useful for broad policy discussions and the development of long-term strategies.

Capacity benchmarks are defined as the maximum number of flights an airport can routinely handle in an hour, for the most commonly used runway configuration in each specified weather condition.

These benchmarks are estimates of a complex quantity that varies widely with weather, runway configuration, and the mix of aircraft types. Capacity benchmarks assume there are no constraints in the en route system or the airport terminal area.

Updating the Capacity Benchmarks

The first study of airport capacity benchmarks was published by the FAA in April 2001.[1] Changes in aviation since then, and a better understanding of potential uses of benchmark data, have led to this update to the 2001 benchmark report.

These updated benchmarks should not be compared to the original benchmarks to identify progress since 2001. Refinements to the methodology and different scenario definitions have produced more meaningful and internally consistent benchmark values, but may make comparisons to the original benchmarks misleading. These changes are explained below in the section titled "Differences from Previous Benchmark Report."

The general definition of the benchmarks, and the purpose for developing them, have not changed from the 2001 report.

The Capacity Benchmarks documented in this report were used as a part of the analytical support for the Future Airport Capacity Task (FACT) study, *Capacity Needs in the National Airspace System.*[2] FACT took a new approach to assessing our country's future needs for airport capacity in metropolitan areas. It looked at population trends, economic and societal shifts, and the changing dynamics of the airline industry. While the FACT took a broad look at future airport capacity, the Benchmark report is a more focused look at capacity at specific airports from an operational perspective.

Setting the Framework for Benchmarks

The benchmarks in this report are a relatively simple expression of a complex quantity, airport capacity. They serve primarily as a reference point on the state of selected U.S. airports at a specific time. They can be used to identify and compare specific characteristics of airports, for instance to determine which airports are most severely affected by adverse weather. The benchmarks also provide a context for public policy discussions, because they give a succinct report on the current and future state of capacity at major airports.

Benchmarks are useful data that can help frame discussions. However, they are not a substitute for the more detailed analysis that should precede major investment and policy decisions. In this sense they might be compared to a vital sign of human health, such as blood pressure. That simple indicator might be the starting point for a diagnosis, but more tests would be performed before recommending surgery. Similarly, capacity benchmarks help identify problem areas but are not, in themselves, an adequate basis for selecting remedies.

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[1] *Airport Capacity Benchmark Report 2001*, Federal Aviation Administration.

[2] Available at www.faa.gov/arp/publications/reports/index.cfm.

This issue can be demonstrated by examining busy airports such as Hartsfield-Jackson Atlanta International Airport or Chicago O'Hare. At Atlanta, scheduled operations may exceed the benchmarks in optimum weather, and frequently do so in bad weather. A simple comparison of schedule to benchmarks might suggest that some action is needed to curtail the schedule. However, air traffic controllers, airlines, and the airport operator have indicated in discussions that they are relatively comfortable with the traffic schedule, and believe that it makes efficient use of the airport. Their judgment is based on long experience and a broad understanding of air transportation.

Some of the considerations behind this judgment are applicable to transfer hub airports in general (the concentration of traffic into schedule peaks to allow passengers to make convenient transfers between flights; the ability to catch up with traffic between peaks in the schedule; and the ability of hubbing carriers to cancel and consolidate some flights during poor weather conditions).

Other considerations are applicable to all busy airports, namely the premise that some amount of congestion and delay is not inconsistent with efficient and affordable air transportation.

It should be emphasized that the benchmarks are specific to the airport, and may not represent the actual capacity of the airport when other considerations are included such as airspace structure and congestion, weather patterns, and directional flight limitations.

At Chicago O'Hare, for example, the average arrival and departure rates will be less than the benchmark rate, which represents operations in good weather in the most favorable runway configuration. Wind conditions frequently force the use of other configurations with lower rates. The actual rate of arrivals and departures may also be affected by traffic flow control measures, such as mile-in-trail restrictions caused by en route weather or airspace constraints.

Methodology

The FAA and The MITRE Corporation have updated the capacity benchmarks for the 31 airports published in 2001 and developed capacity benchmarks for four additional airports (Cleveland, Fort Lauderdale-Hollywood, Chicago Midway, and Portland, Oregon), bringing the total to 35. These are the same 35 airports listed in the FAA's Operational Evolution Plan (OEP) version 5.0, released in December 2002.[3] This update reflects the future capacity gains associated with the new runways and technology improvements identified in OEP v5.0.

The benchmarks are the sum of takeoffs and landings per hour that are possible under the given conditions, if the demand is present. The benchmark capacity usually represents balanced operations, with equal numbers of arrivals and departures. However, if air traffic control (ATC) at the airport frequently reports an unbalanced rate, the benchmark value will reflect this. For example, the airport might be able to handle 40 arrivals per hour but as many as 60 departures per hour. Clearly, the airport cannot operate more departures than arrivals for an extended period: such rates describe the capability of the airport to accommodate operations, not necessarily actual hourly traffic.

These benchmarks are based on routine operations at the airports, and therefore they might be exceeded occasionally under favorable conditions. Conversely, lower rates would be expected under adverse conditions, such as a lower capacity runway configuration or very low ceiling and visibility, or if demand is significantly less than capacity.

[3] Available at www.faa.gov/programs/oep.

There are three benchmarks published for each airport, reflecting three different weather scenarios (Optimum, Marginal, and IFR[4]). The benchmark capacity is defined as the maximum number of aircraft that can be routinely and safely handled during each specified condition:

- **Optimum**: periods of unlimited ceiling and visibility, using visual approaches.
- **Marginal**: periods when the weather is not good enough for visual approaches, but is still better than instrument conditions.
- **IFR**: instrument conditions (ceiling less than 1000 feet or visibility less than 3 statute miles), when radar separation between aircraft is required.

The frequency of occurrence of these weather conditions at each airport was determined for this analysis using data from the FAA Aviation System Performance Metric [ASPM] database. The time period selected was from January 2000 to July 2002 (excluding 11-14 September 2001). Only data between 7 AM and 10 PM local time at each airport was used, to avoid periods of very low activity.

Weather data in ASPM is obtained directly from NOAA. Based on the ceiling and visibility data, and the visual approach minima for each airport, ASPM indicates whether visual or instrument approaches are conducted at the airport.

Each rate is based on the *most commonly used runway configuration* for that condition. For example, the most common configuration at New York LaGuardia Airport in Optimum weather is to use Runway 22 for arrivals and Runway 13 for departures.

The FAA confirmed capacity benchmark rates in three ways:

- Rates for each airport were provided by the ATC team at the airport, both control tower and terminal radar control (TRACON) personnel, based on their collective operational experience and a review of the ASPM data on reported rates.
- The rates provided by the air traffic teams were compared to historical traffic data for arrivals and departures (also from ASPM) to confirm that they represent the best performance of the airport.
- Rates were also calculated based on a set of standard performance characteristics, using the FAA's widely accepted airfield capacity computer model.
- In general, bad weather reduces the capacity of the airport but does not reduce the number of scheduled flights. Under good weather conditions (i.e., Optimum weather), delays at most airports are expected to be small and manageable. During bad weather, however, capacity is lower, resulting in more delay. The difference in the benchmarks for the different weather scenarios is one indicator of the potential effect of weather at a specific airport.

Human factors play a critical role in the benchmark rates reported by the air traffic facility. Benchmarks are strongly affected by how busy the airport is and how aggressively the management team sets target rates.

Assumptions

Version 5.0 of the OEP describes improvements to the National Airspace System (NAS) that will be tested, developed, and/or implemented in the period from 2003-2013. Future benchmarks were calculated for 2013 assuming that the technological and procedural improvements described in OEP v5.0 will be implemented at all eligible airports, and will provide the expected benefits. As such, the values presented should be considered as upper limits of the effect of the OEP improvements on benchmark capacity. Please note that the future benchmarks do not substitute for detailed benefit analyses performed for the individual programs.

[4] Conditions when Instrument Flight Rules (IFR) apply.

The improvements listed in OEP v5.0 included new runways at many of the 35 OEP airports. New benchmark capacities were calculated for each of these airports to show the effect of these planned runways. The benchmark capacities associated with the new runways assume that the airspace design, technology, and ATC procedures needed for full operational performance of the new runway have been implemented. These capabilities include but are not limited to the following:

- **Simultaneous Offset Instrument Approaches (SOIA)** refers to instrument approaches to a set of parallel runways less than 3000 feet apart, utilizing a straight-in precision approach to one and an offset approach to the other. With SOIA, the approach course separation meets parallel approach criteria even though the runway separation does not.
- **Precision Runway Monitor (PRM)** is a high update radar system that allows simultaneous instrument approaches to parallel runways as close as 3000 feet apart. PRM can also facilitate other approach procedures such as SOIA.
- **Standard Terminal Automation Replacement System (STARS)** enhancements provide a high-resolution color monitor with alert algorithms, similar to that provided by the PRM but without the high update rate. Such a monitor is required to conduct triple simultaneous instrument approaches when the runway centerlines are at least 4300 but less than 5000 feet apart, or the field elevation is at or above 1000 feet above Mean Sea Level (MSL).

OEP v5.0 also includes several technical and procedural improvements:

- **Traffic Management Advisor (TMA)** provides traffic flow managers with a metering plan that organizes traffic in en route airspace to increase the utilization of the airport's arrival capacity, and implements that plan by displaying specific aircraft schedule and delay information to en route controllers. When the controllers deliver the aircraft to the airport airspace boundary at the TMA scheduled times, the orderly flow of arrival traffic results in more efficient operations. When fully implemented, TMA will help an airport more consistently utilize its capacity.
- **Area navigation (RNAV)** capabilities on the aircraft, in conjunction with advanced TMA functions, are assumed to improve the accuracy with which arrivals are delivered to the runway. In other words, the actual separation between arrivals will be closer to the minimum required separation value.
- **CDTI[5]-Enhanced Flight Rules (CEFR)** allows suitably equipped aircraft to maintain visual separation from other aircraft and continue visual approaches even in Marginal weather conditions. For the purpose of this analysis, it was assumed that all aircraft at these 35 airports will be suitably equipped by 2013; actual equipage will probably be less.
- **Revised wake vortex separation standards for closely spaced parallel runways** would improve arrival and departure capacity when the runways are less than 2500 feet apart. Additional separation for wake turbulence would only be applied between operations on different runways when actually needed, such as for a Small aircraft on one runway trailing a Heavy aircraft on the other runway. Other aircraft would use non-vortex separation, such as 1.5 nautical miles (NM) diagonally between arrivals.
- **Airspace redesigns** may be needed at various airports to allow full operational use of the new runways. This analysis also assumed that the airspace redesign would be successful in eliminating most operational restrictions on arrivals and departures at these airports. Restrictions due to terrain or environmental concerns would not be affected.

The list of Planned Improvements and their expected effects on capacity at each airport does not imply FAA commitment to or approval of any item on the list.

[5] Cockpit Display of Traffic Information.

In general, the benchmarks do not consider any limitation on airport traffic flow that may be caused by non-runway constraints at the airport or elsewhere in the NAS. Such constraints may include:

- Taxiway and gate congestion, runway crossings, slot controls, construction activity.
- Terminal airspace, especially limited departure headings.
- Traffic flow restrictions caused by en route miles-in-trail restrictions, weather, or congestion problems at other airports.
- Seasonal limitations due to high temperatures that restrict aircraft climb rates.

These benchmark capacity values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

Differences from Previous Benchmark Report

The same general methodology is used for these updated benchmarks as was used to produce the April 2001 benchmark report. However, this methodology has been refined based on responses to the original set of benchmarks and to incorporate additional data now available. As a result, the benchmark values for many airports have changed from the original report. Some of the reasons for these differences are explained below. Because of these refinements to the methodology and different input data used, these updated benchmarks should not be compared to the 2001 benchmarks.

The 2001 benchmark report provided capacities for two weather conditions, Optimum and Reduced rate. "Reduced rate" was based on the runway configuration used most often during less than optimal conditions, which might have been Marginal conditions or IFR conditions, with different ATC procedures. Different airports specified different weather conditions for the "reduced rate" scenario, leading to inaccurate comparisons between airports. Having separate benchmarks for Marginal and IFR conditions should make such comparisons more meaningful.

The 2001 benchmark report also compared scheduled arrivals and departures to Optimum and Reduced rate conditions for a selected day of good and poor weather conditions. This single-day comparison, while a useful indicator of potential airport performance for that day, was originally provided to show the comparative effect of adverse weather at airports having different levels of capacity and demand. This report focuses exclusively on airport capacity and does not include comparative schedule data.

The most common runway configuration and the facility-reported arrival and departure rates are based on more than two years of data in the FAA ASPM database. This better data, together with changes in airport operations and runway configurations, led to modeling different runway configurations and revised facility-reported rates in some cases.

Airport fleet mix is an input parameter to the computer model used to calculate the benchmarks. The fleet mix used in this report is based on recent traffic data, and therefore reflects changes in scheduled operations at the benchmark airports.

The charts of actual traffic versus calculated capacity now include more than two years of ASPM data, and the data points are coded to show frequency of occurrence. This gives a better understanding of routine operations vs. exceptional events.

Observations Across All 35 Airports

Table 1 shows the capacity benchmarks for current operations at the 35 airports studied. These benchmarks are represented as a range between the value reported by the ATC facility, either the control tower or the TRACON, and the value calculated using the capacity model. The benchmarks are also depicted graphically in Figure 1, which plots the calculated benchmark values. The calculated values are used here for consistency with the future capacity values.

Table 1
Capacity Benchmarks for Today's Operations at 35 Airports
(Arrivals and Departures per Hour)

Airport		Optimum	Marginal	IFR
ATL	Atlanta Hartsfield-Jackson International	180-188	172-174	158-162
BOS	Boston Logan International	123-131	112-117	90-93
BWI	Baltimore-Washington International	106-120	80-93	60-71
CLE	Cleveland Hopkins	80-80	72-77	64-64
CLT	Charlotte/Douglas International	130-131	125-131	102-110
CVG	Cincinnati/Northern Kentucky International	120-125	120-124	102-120
DCA	Ronald Reagan Washington National	72-87	60-84	48-70
DEN	Denver International	210-219	186-202	159-162
DFW	Dallas/Fort Worth International	270-279	231-252	186-193
DTW	Detroit Metro Wayne County	184-189	168-173	136-145
EWR	Newark Liberty International	84-92	80-81	61-66
FLL	Fort Lauderdale-Hollywood International	60-62	60-61	52-56
HNL	Honolulu International	110-120	60-85	58-60
IAD	Washington Dulles International	135-135	114-120	105-113
IAH	Houston George Bush Intercontinental	120-143	120-141	108-112
JFK	New York John F. Kennedy International	75-87	75-87	64-67
LAS	Las Vegas McCarran International	102-113	77-82	70-70
LAX	Los Angeles International	137-148	126-132	117-124
LGA	New York LaGuardia	78-85	74-84	69-74
MCO	Orlando International	144-164	132-144	104-117
MDW	Chicago Midway	64-65	64-65	61-64
MEM	Memphis International	148-181	140-167	120-132
MIA	Miami International	116-121	104-118	92-96
MSP	Minneapolis-St Paul International	114-120	112-115	112-114
ORD	Chicago O'Hare International	190-200	190-200	136-144
PDX	Portland International	116-120	79-80	77-80
PHL	Philadelphia International	104-116	96-102	96-96
PHX	Phoenix Sky Harbor International	128-150	108-118	108-118
PIT	Greater Pittsburgh International	152-160	143-150	119-150
SAN	San Diego International - Lindbergh Field	56-58	56-58	48-50
SEA	Seattle-Tacoma International	80-84	74-76	57-60
SFO	San Francisco International	105-110	81-93	68-72
SLC	Salt Lake City International	130-131	110-120	110-113
STL	Lambert-St. Louis International	104-113	91-96	64-70
TPA	Tampa International	102-105	90-95	74-75

Airport capacity generally decreases in adverse weather conditions, which may include poor ceiling and visibility (requiring different ATC procedures), unfavorable winds (so the best runway configuration cannot be used), or heavy precipitation.

The extent of the reduction in benchmark capacity during operations in IFR conditions (as compared to the Optimum scenario) varies widely across the 35 airports, from almost no effect at Minneapolis-St. Paul, to a 47 percent reduction at Honolulu. These differences are due to different runway configurations and operational procedures in adverse weather at each airport.

Table 2 shows the percentage increase in the capacity benchmarks at these airports due to planned new runways and the technological and procedural improvements included in OEP v5.0. The effect of these improvements on the calculated benchmark values is shown in Figures 2 through 4 (Optimum, Marginal, and IFR scenarios respectively).

New runways planned for 12 airports provide significant capacity increases, but the amount of the increase varies from site to site. OEP v5.0 included new runways in the 2003-2013 period at Atlanta, Boston, Cincinnati, Cleveland, Denver, Houston, Miami, Minneapolis-St. Paul, Orlando, St. Louis, Seattle-Tacoma, and Washington Dulles. These planned new runways increased the benchmark capacities by 25 to 50 percent at most airports.

- A smaller increase in the benchmark capacity might occur where there are operational restrictions on the new runway. For example, the new runway at Minneapolis-St. Paul can only be used for operations to or from south of the airport. The new runway at Boston has no effect on the benchmarks because it will only be used when there are strong winds from the northwest, which is not a common occurrence.
- Additional airports such as Chicago O'Hare are planning new runways, but these runways were not included OEP v5.0 and thus were not considered in this analysis. In general, a proposed new runway is not included in the OEP unless the FAA has issued a Record of Decision (ROD) after a satisfactory environmental study. The environmental study for the new runways at O'Hare has not yet been completed.

Technology and procedural improvements also provide capacity increases. CEFR will increase the benchmark capacity in Marginal conditions. The revised wake vortex procedures will increase the benchmarks at airports with closely spaced parallel runways. Airspace redesign has the potential to allow large increases at some airports, but only if the redesign eliminates existing operational restrictions.

For those airports operating close to capacity, technological and procedural changes could have a significant impact in improving the capacity benchmark. In general, the greatest benefit is derived from adding a new runway.

Figure 1
Effect of Weather on Capacity Benchmarks – Today

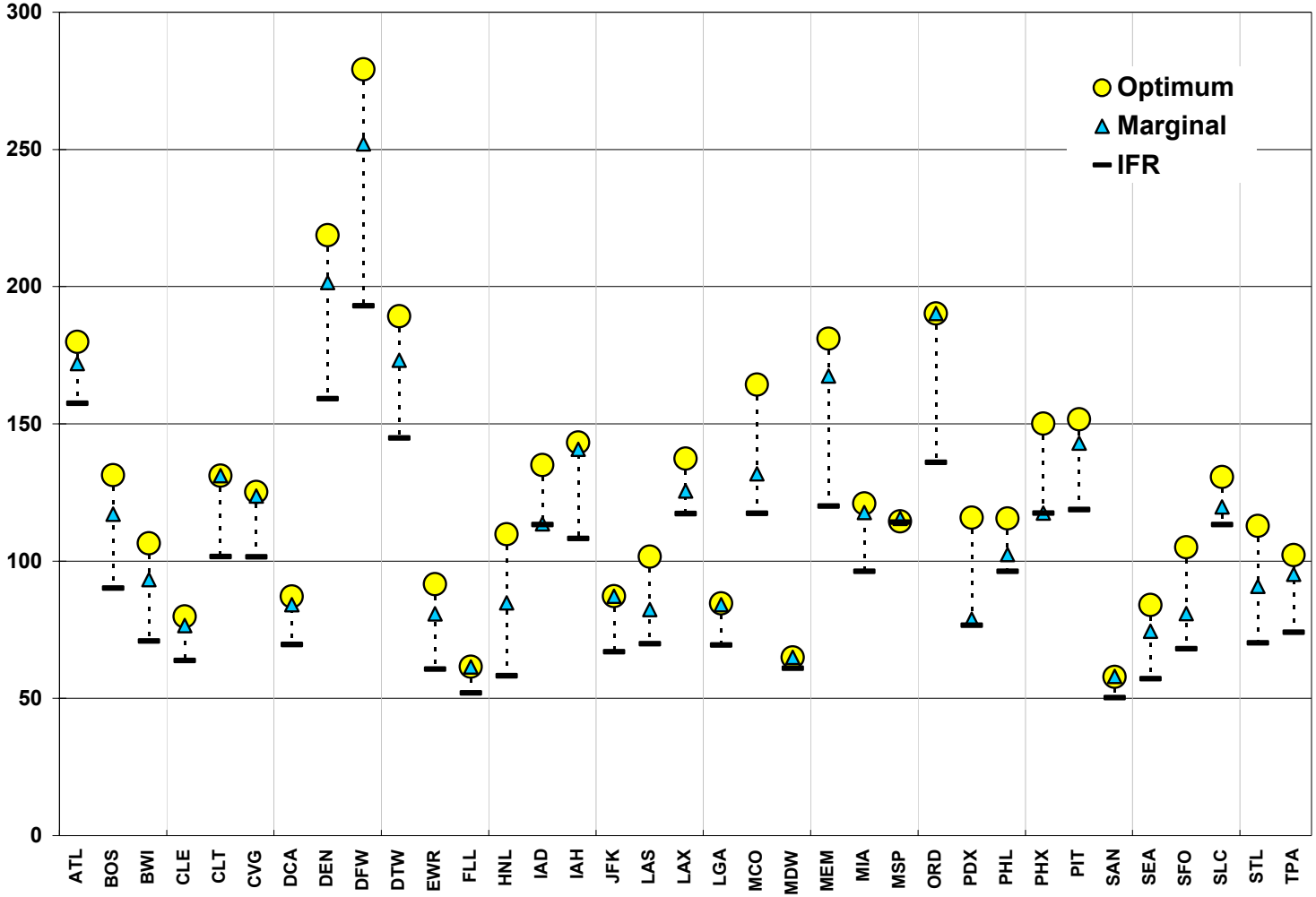


Table 2
Capacity Benchmark Summary

Airport	Capacity Improvement over Today (percent)					
	New Runway (if planned)			Planned Improvements (including new runway)		
	Optimum	Marginal	IFR	Optimum	Marginal	IFR
ATL	32	33	28	35	40	40
BOS	0	0	0	0	11	0
BWI	—	—	—	0	0	0
CLE	44	51	37	44	51	37
CLT	—	—	—	0	0	0
CVG	35	34	30	41	43	39
DCA	—	—	—	0	0	0
DEN	22	24	43	29	39	48
DFW	—	—	—	9	20	6
DTW	—	—	—	0	8	0
EWR	—	—	—	1	7	0
FLL	—	—	—	0	0	0
HNL	—	—	—	0	22	43
IAD	27	51	33	29	53	33
IAH	35	37	22	61	64	27
JFK	—	—	—	0	0	0
LAS	—	—	—	1	21	0
LAX	—	—	—	26	38	9
LGA	—	—	—	0	1	0
MCO	35	47	42	35	54	48
MDW	—	—	—	9	9	0
MEM	—	—	—	6	13	4
MIA	23	7	18	28	29	25
MSP	40	35	10	46	44	20
ORD	—	—	—	0	0	0
PDX	—	—	—	0	38	0
PHL	—	—	—	0	7	0
PHX	—	—	—	0	1	0
PIT	—	—	—	0	6	10
SAN	—	—	—	0	0	0
SEA	22	35	27	22	35	27
SFO	—	—	—	8	40	1
SLC	—	—	—	22	34	0
STL	34	54	63	41	71	68
TPA	—	—	—	0	7	0

Figure 2
Effect of New Runways and Planned Improvements on Capacity Benchmarks – Optimum Weather

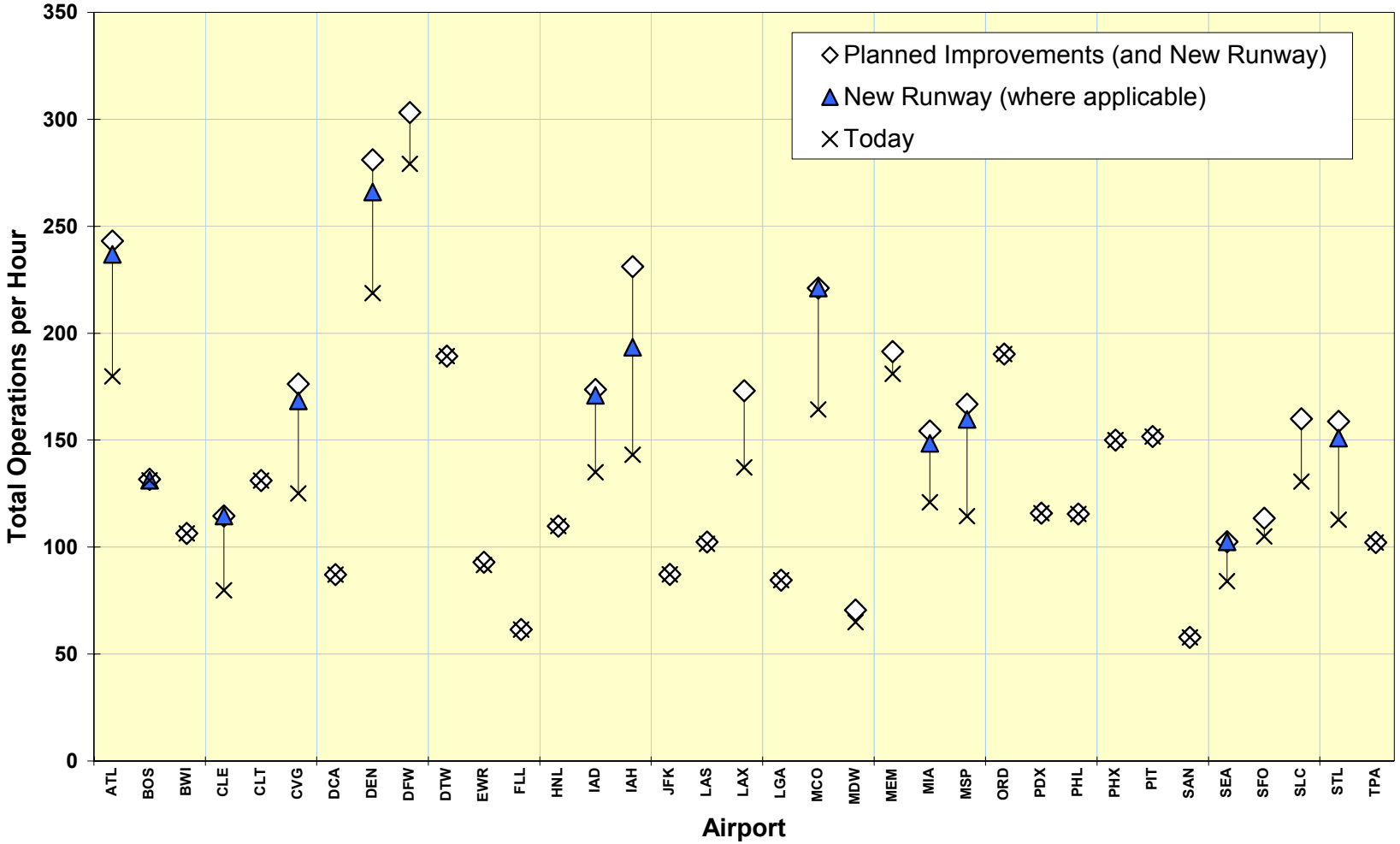


Figure 3
Effect of New Runways and Planned Improvements on Capacity Benchmarks – Marginal Weather

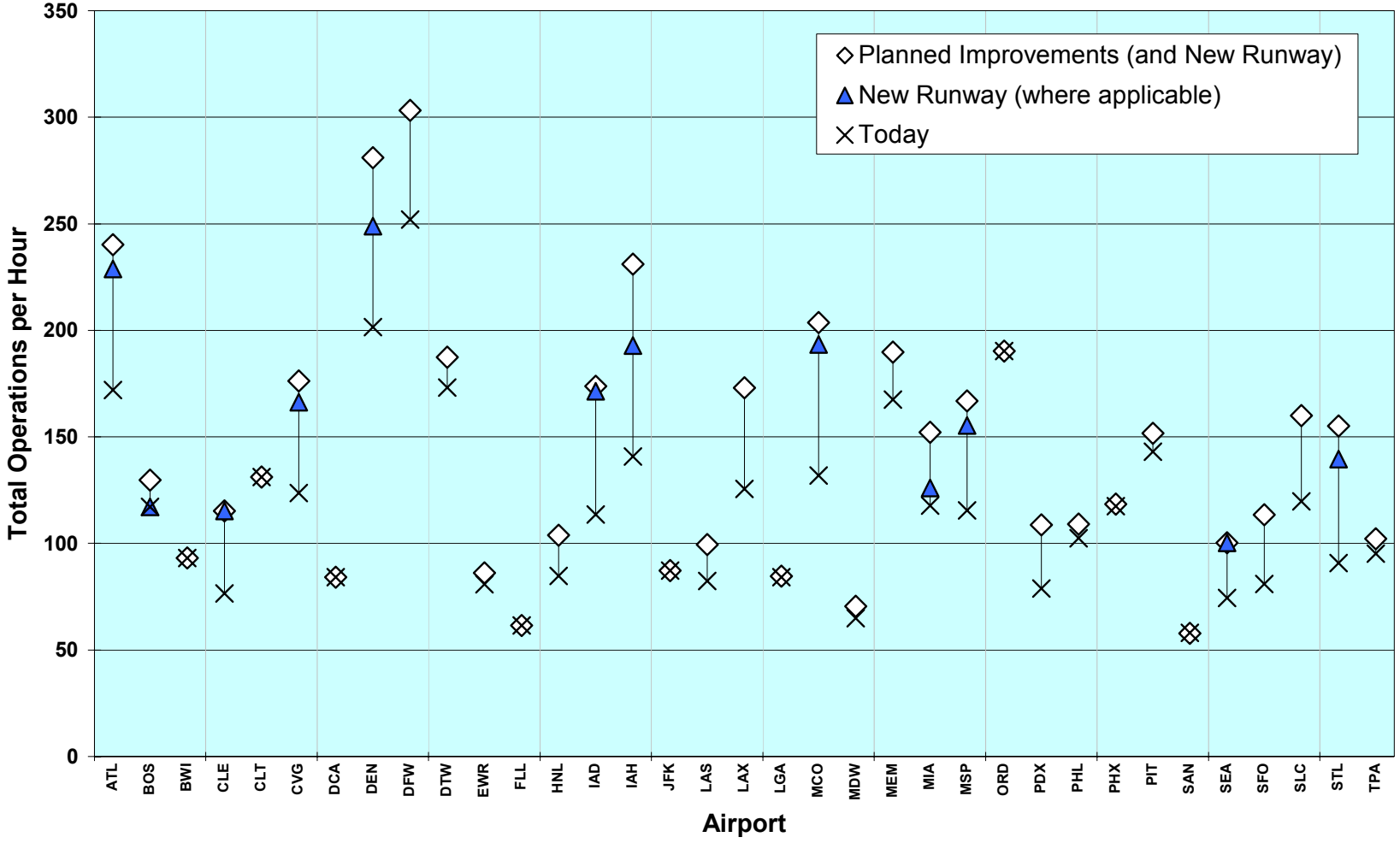
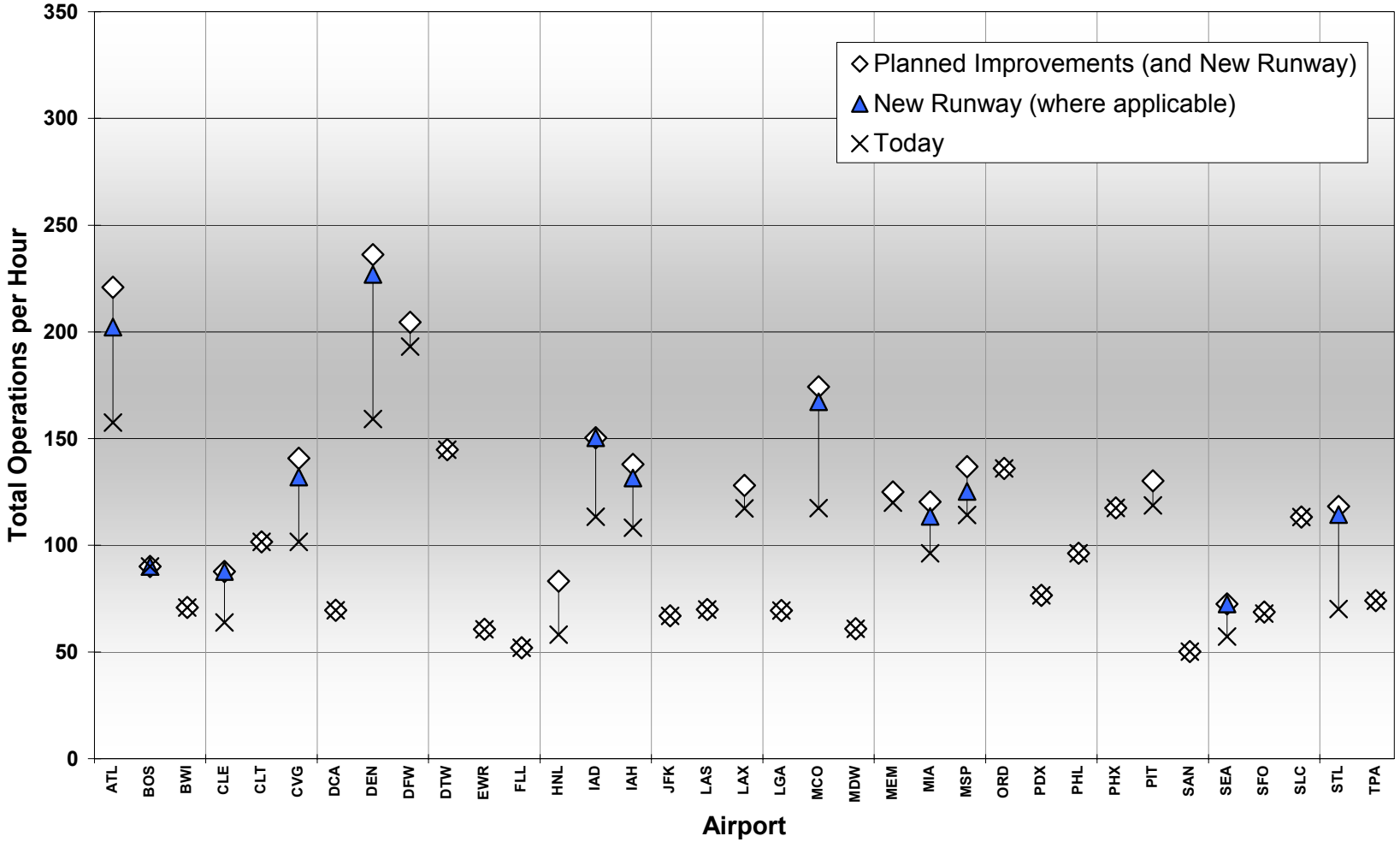


Figure 4
Effect of New Runways and Planned Improvements on Capacity Benchmarks – IFR Weather



Individual Airport Results

The following sections present the benchmark results for each of the 35 airports individually. The airports are presented in alphabetical order by the three-letter airport code, from ATL to TPA, as in the prior tables and figures.

Each section describes the runway configurations that were analyzed for each weather scenario, the air traffic control procedures used, and the effect of planned improvements at the airport. If construction of a new runway has been approved at the airport, the effect of the runway is discussed separately.

Airport capacity was calculated using the FAA's Airfield Capacity Model. This runway capacity is the calculated average number of arrivals and departures per hour, given continuous arrival and departure demand. An airport operating at capacity would experience significant levels of delay.

Capacity results for each weather condition are shown for each airport graphically. Calculated capacity is depicted as a line rather than as a single point, to show the tradeoff between arrival and departure operations at the airport. Typically, the number of arrivals per hour will decrease as the number of departures increases, for at least a section of the "capacity curve," since both arrivals and departures use the same runways (e.g., SAN). But in certain cases (e.g., ATL), arrivals are independent of departures so there is no tradeoff, and the "capacity curve" is a rectangle.

The capacity graphs show the calculated number of arrivals and departures per hour as well as the arrival and departure rate reported by the ATC facility. If the reported rate is, for example, 60 arrivals per hour and 30 departures per hour, it would be abbreviated as (60, 30).[6] The benchmark capacity is usually expressed as a range between the facility-reported rate and the corresponding point on the calculated capacity curve.

Actual traffic data is also shown on the capacity charts. This data represents operations at each airport from January 2000 through July 2002, between the hours of 7 a.m. and 10 p.m. local time (Source: ASPM). Each combination of arrivals and departures may have occurred multiple times during this period. On the following charts, four different symbols are used to depict how frequently these combinations occur, with each symbol used for roughly a quarter of the observed hours.

The ASPM data was also used to determine the runway configuration and weather condition information. However, information on runway configuration usage was not available in ASPM for all airports. The most common configuration was initially determined using ASPM data, where possible, but was confirmed through discussion with the ATC facility.

An airport layout diagram is included for each airport to better understand the various runway configurations that were analyzed. Planned runway construction is shown in these layouts by a different color. These diagrams were taken mainly from the 2001 and 2002 *Aviation Capacity Enhancement Plans*[7] published by the FAA; however, there may be differences between these pictures and the precise details of the runways, taxiways, and buildings at the airport.

Note: These benchmarks do not consider any limitation on airport traffic flow that may be caused by non-runway constraints at the airport or elsewhere in the NAS. Such constraints may include:

- Taxiway and gate congestion, runway crossings, slot controls, or construction activity.
- Terminal airspace, especially limited departure headings.
- Traffic flow restrictions caused by en route miles-in-trail restrictions, weather or congestion problems at other airports.

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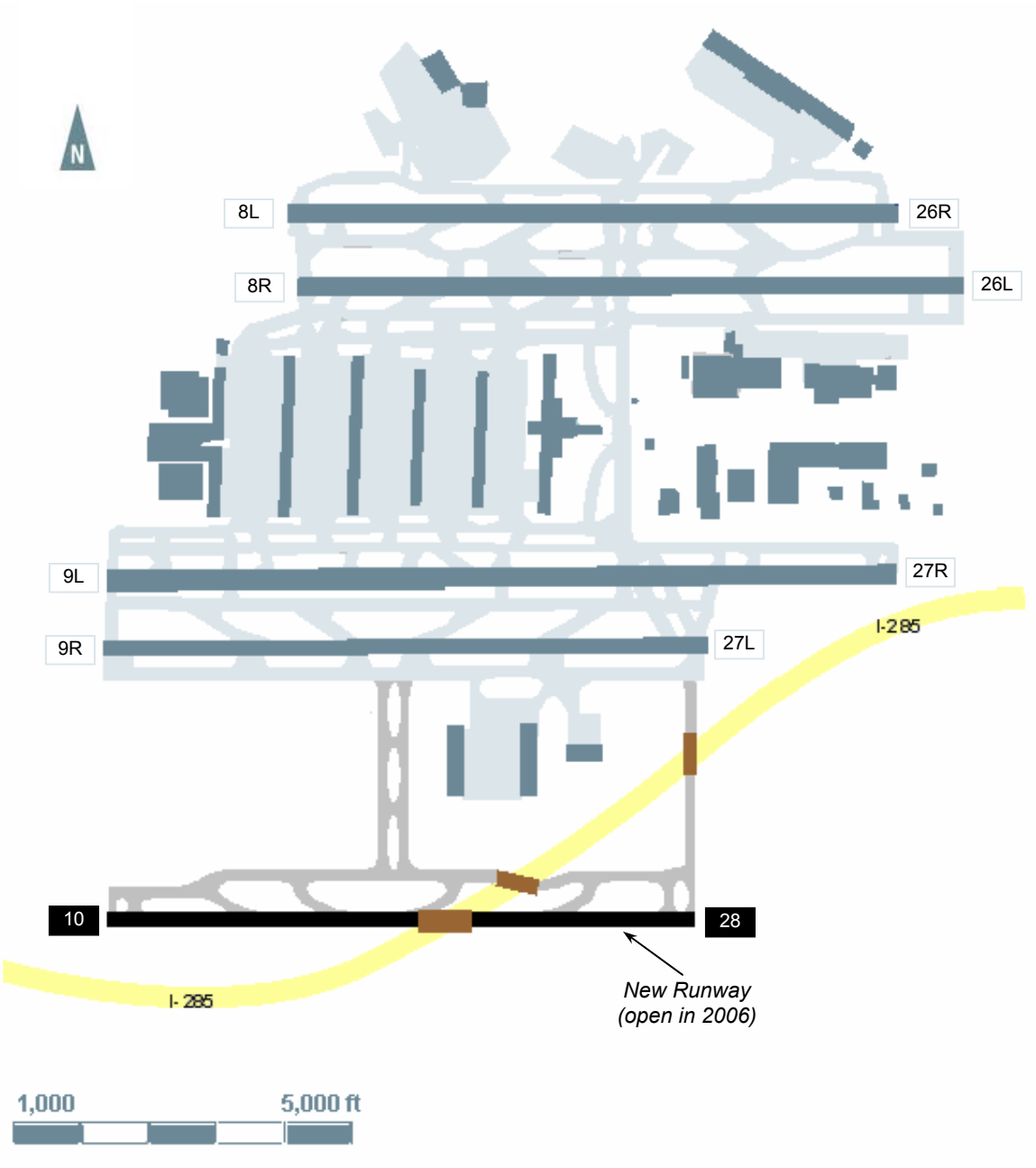
[6] Normally in a graph, the value on the x-axis is presented first. Here, that would be the number of departures. The representation herein is thus the opposite of the conventional presentation.

[7] Available at www.faa.gov/ats/asc/.

Individual Airport Reports

ATLANTA – Hartsfield-Jackson Atlanta International (ATL)



Benchmark Results

- The capacity benchmark for Hartsfield-Jackson Atlanta International Airport today is 180-188 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark decreases slightly, to 172-174 flights per hour in Marginal conditions, and to 158-162 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Additional operations may be possible under other conditions, such as additional arrivals on a departure runway. On the other hand, throughput may be less when ceiling and visibility are low, or if adverse winds affect aircraft performance.
- Note that if the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rate will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- A new runway, planned for completion in 2006, will allow triple simultaneous approaches and an additional departure stream, increasing the benchmark rate by 28-33 percent. This increase can occur *only* if ground infrastructure (including a PRM system), environmental constraints, and other operational factors allow the planned use of the new runway. The increase in actual operations may be less if airspace restrictions prevent full use of the new runway.
- Other planned technological improvements at ATL would increase the benchmark rate slightly in Optimum and Marginal conditions, but by up to 12 additional percentage points in IFR conditions, compared to today. The additional benefit in IFR conditions derives mainly from improved delivery accuracy that is assumed to result from advanced TMA and RNAV procedures.
- This increased delivery accuracy, together with the new runway, is also expected to increase throughput significantly during arrival peaks.
- In the following charts, please note that a number of hourly traffic points fall outside the calculated capacity curves at ATL. There are many possible reasons why this may occur without affecting operational safety. The departure runways at ATL are sometimes used for arrivals as well, increasing arrival throughput. Efficient aircraft sequencing or above-average pilot and controller performance can also contribute to higher throughputs. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

ATLANTA – Hartsfield-Jackson Atlanta International Airport (ATL)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 26R, 27L Departures on 26L, 27R *Frequency of Use: 68% in Optimum conditions*	Visual approaches, visual separation	**180-188**
Ceiling and visibility above minima for visual approaches (3600 ft ceiling and 7 mi visibility)	**New Runway (2006)**	Arrivals on Runways 26R, 27L, 28 Departures on 26L, 27R, 28	Same, with triple simultaneous visual approaches	**237**
Occurrence: 76%	**Planned improvements (2013), including new runway**	Same		**243**
Marginal Rate	**Today**	Arrivals on Runways 26R, 27L Departures on 26L, 27R *Frequency of Use: 60% in Marginal conditions*	Instrument approaches, visual separation	**172-174**
Below visual approach minima but better than instrument conditions	**New Runway (2006)**	Arrivals on Runways 26R, 27L, 28 Departures on 26L, 27R, 28	Same, with triple simultaneous approaches	**229**
Occurrence: 14%	**Planned improvements (2013), including new runway**	Same	Triple simultaneous visual approaches, visual separation	**240**
IFR Rate	**Today**	Arrivals on Runways 8L, 9R Departures on 8R, 9L *Frequency of Use: 65% in IFR conditions*	Instrument approaches, radar separation	**158-162**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway (2006)**	Arrivals on Runways 8L, 9R, 10 Departures on 8R, 9L, 10	Same, with triple simultaneous instrument approaches	**202**
Occurrence: 10%	**Planned improvements (2013), including new runway**	Same		**221**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

Full operational use of the new parallel runway will require PRM, to enable triple simultaneous instrument approaches, and an airspace redesign to deliver aircraft efficiently to the approaches.

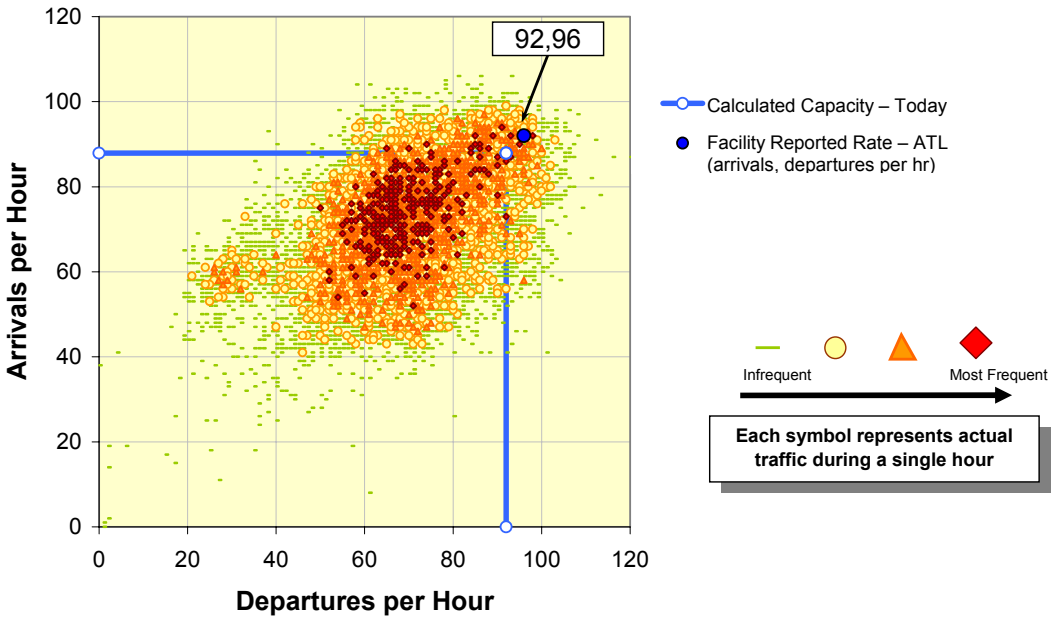
Other planned Improvements at ATL include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Advanced TMA/RNAV, to improve delivery accuracy and help ATL consistently utilize available capacity.

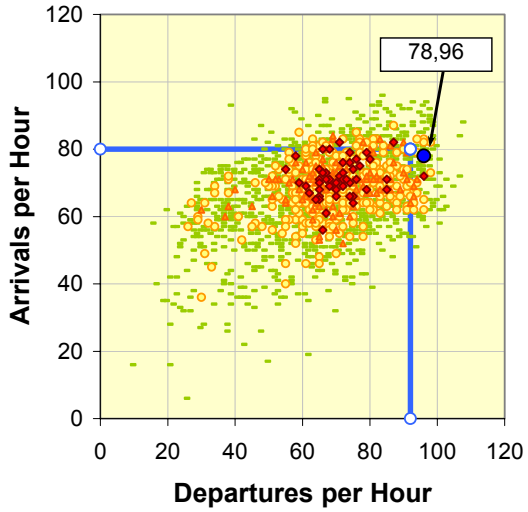
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

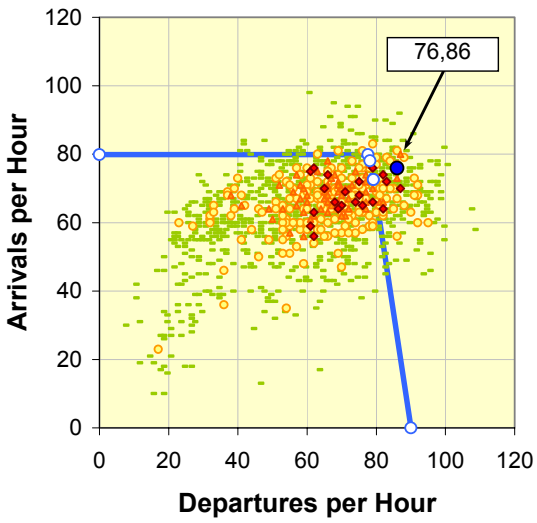
Optimum Rate



Marginal Rate

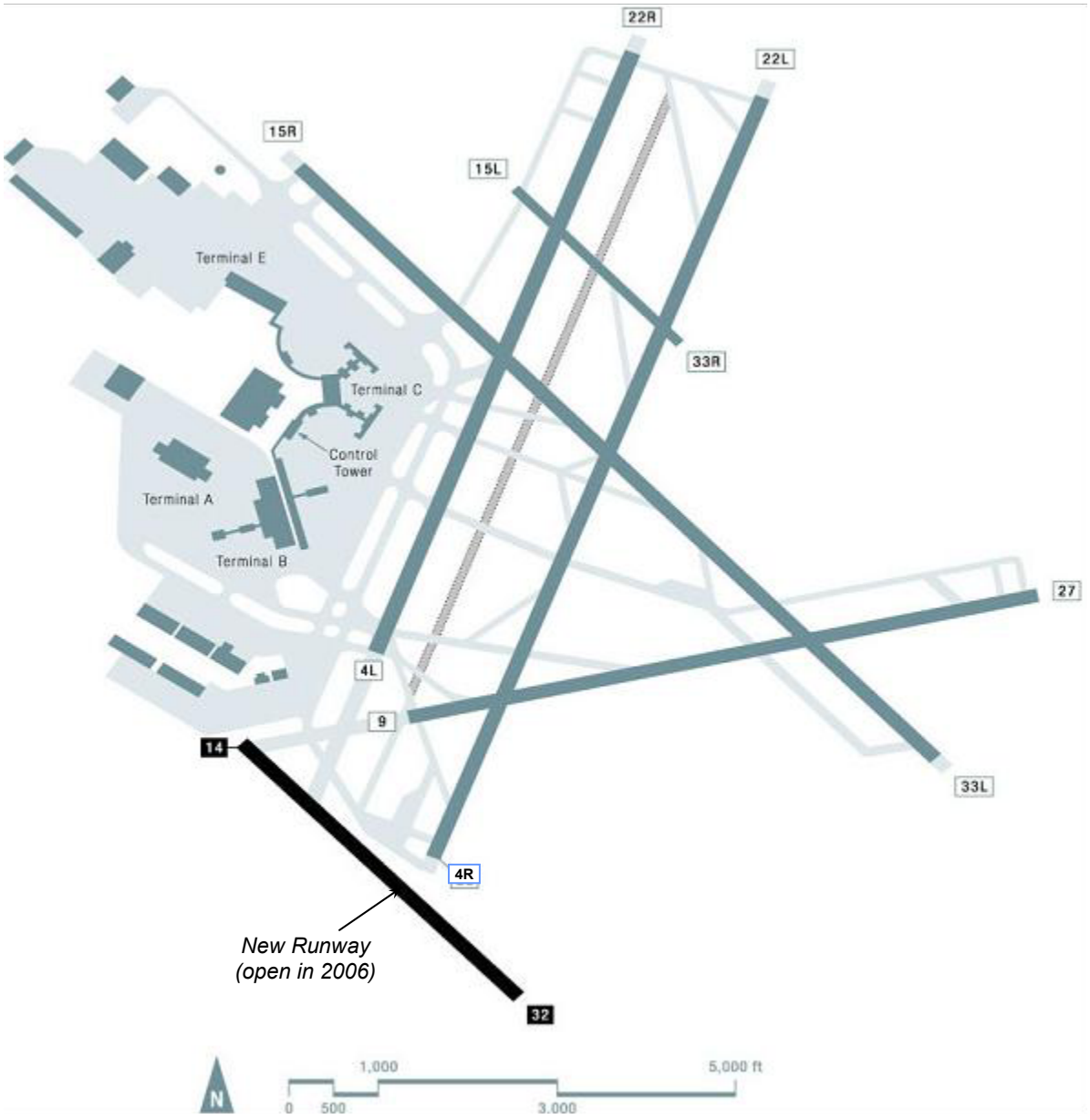


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were coordinated with ATC personnel at ATL.

BOSTON – Boston Logan International (BOS)



Benchmark Results

- The capacity benchmark for Boston Logan International Airport today is 123-131 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark falls to 112-117 flights per hour in Marginal conditions, and 90-93 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Throughput may be less when wind conditions force the use of other configurations, such as arrivals and departures on a single runway.
- Note that these benchmarks do not represent balanced operations. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- A new runway, planned for completion in 2006, will not affect the capacity benchmarks for BOS. Instead, this runway will help to mitigate delays during those weather conditions that force single runway operation today. This assumes that airspace, ground infrastructure, and environmental constraints allow the planned use of the new runway.
- Other planned technological improvements at BOS include CEFR and new wake vortex procedures for operations on the close parallel Runways 04R/L. These improvements would increase the benchmark rate by less than one percent in Optimum and IFR conditions, but by up to 11 percent in Marginal conditions. The benefit in Marginal conditions assumes that all arrivals can use CEFR to maintain visual separations.
- Although the benchmark rates increase only slightly, the planned improvements are expected to increase throughput during arrival peaks.
- In the following charts, please note that a number of hourly traffic points fall outside the calculated capacity curves at BOS, especially in IFR conditions. There are many possible reasons why this may occur without affecting operational safety, including operation on a different runway configuration than the one modeled. Efficient aircraft sequencing or above-average pilot and controller performance can also contribute to higher throughputs. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

BOSTON – Boston Logan International Airport (BOS)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 4L, 4R Departures on 9, 4L, 4R *Frequency of Use: 24% in Optimum conditions*	Visual approaches, visual separation	**123-131**
Ceiling and visibility above minima for visual approaches (2500 ft ceiling and 3 mi visibility)	**New Runway (2006)**	Same		**131**
Occurrence: 82%	**Planned improvements (2013), including new runway**	Same		**132**
Marginal Rate	**Today**	Arrivals on Runways 22L, 27 Departures on 22R, 22L *Frequency of Use: 21% in Marginal conditions*	Instrument approaches, visual separation	**112-117**
Below visual approach minima but better than instrument conditions	**New Runway (2006)**	Same		**117**
Occurrence: 7%	**Planned improvements (2013), including new runway**	Same	Visual approaches, visual separation	**130**
IFR Rate	**Today**	Arrivals on Runways 4R Departures on 9, 4L, 4R *Frequency of Use: 45% in IFR conditions*	Instrument approaches, radar separation	**90-93**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway (2006)**	Same		**90**
Occurrence: 11%	**Planned improvements (2013), including new runway**	Same		**90**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

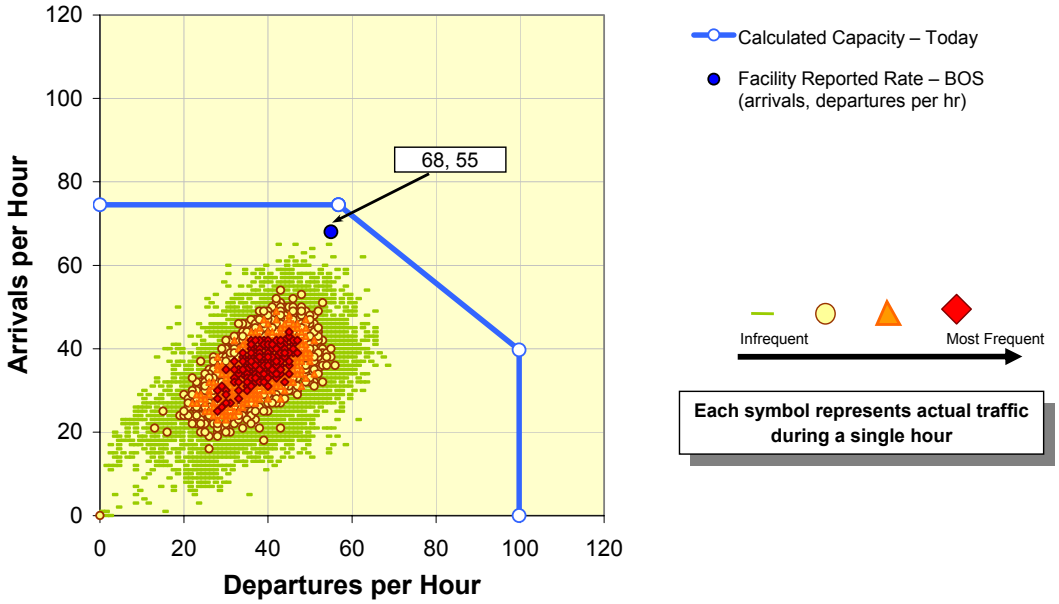
Planned Improvements at BOS include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Revised wake vortex procedures, to increase arrival throughput on closely spaced parallel runways.

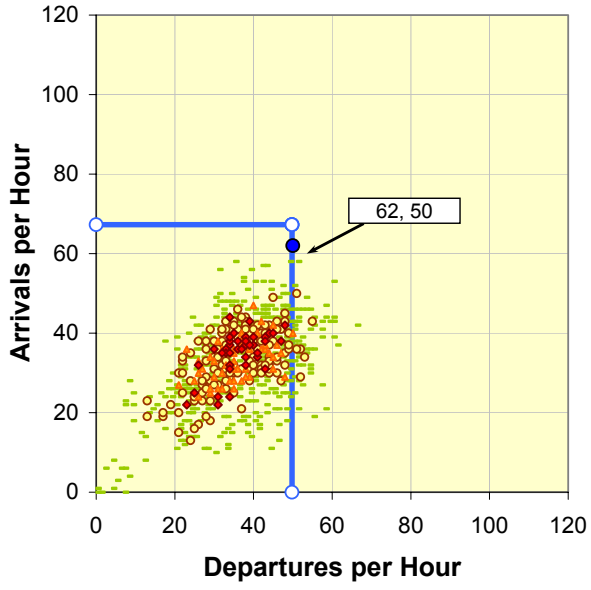
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

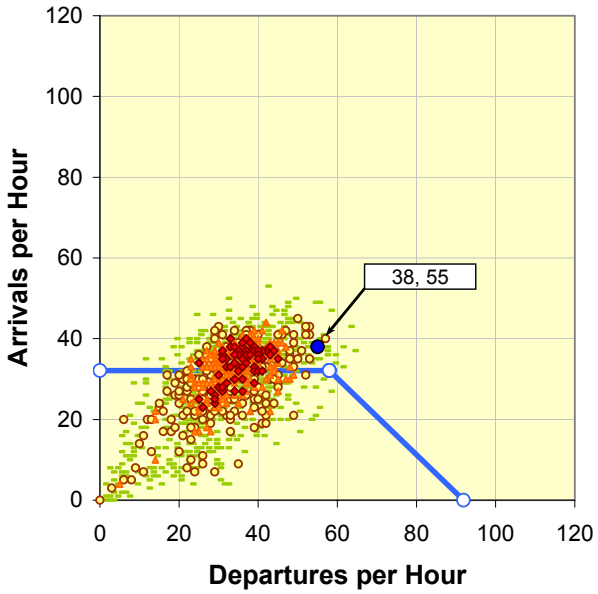
Optimum Rate



Marginal Rate

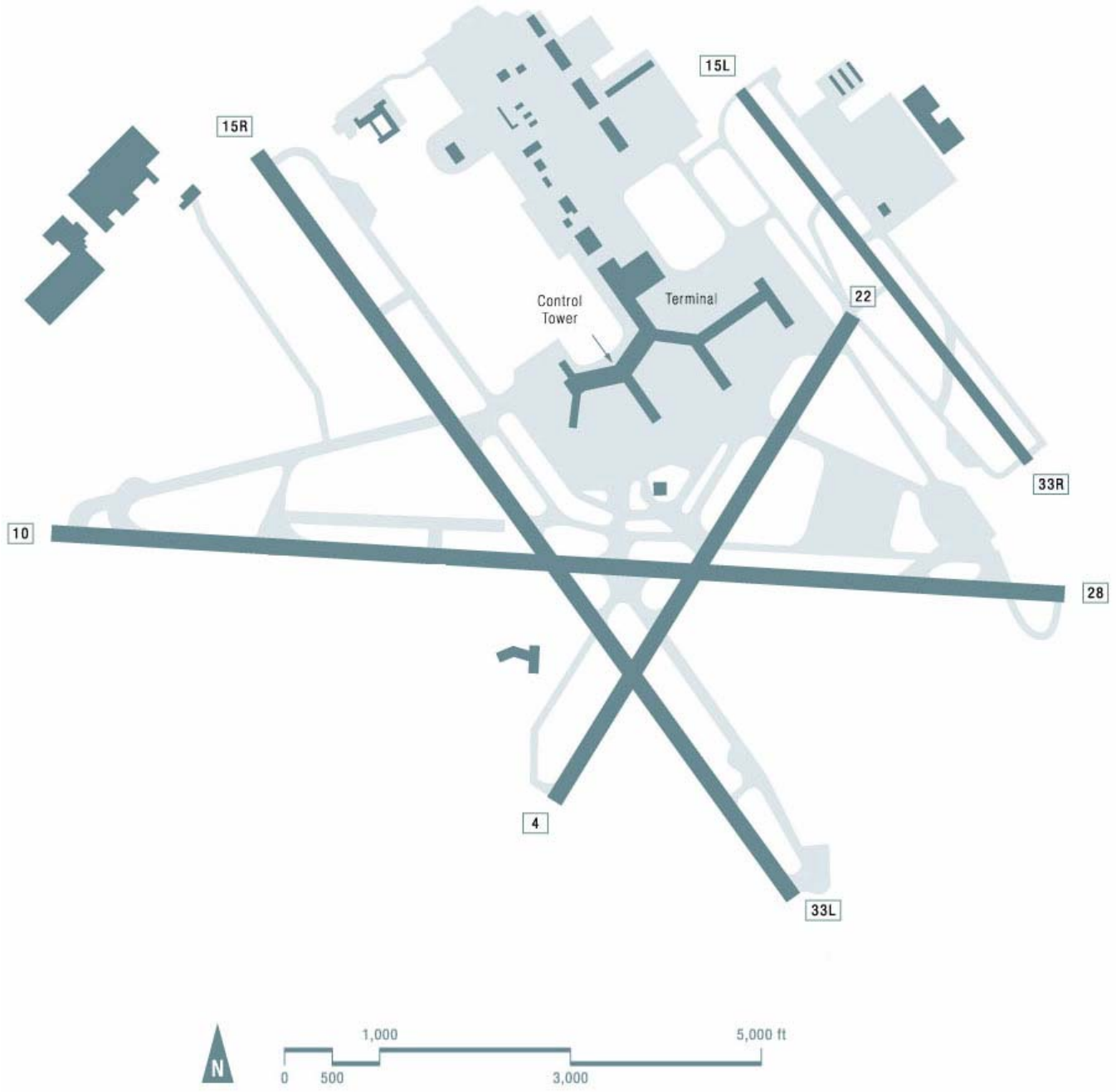


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at BOS.

BALTIMORE – Baltimore/Washington International (BWI)



Benchmark Results

- The capacity benchmark for Baltimore-Washington International Airport today is 106-120 flights per hour (arrivals and departures) in Optimum weather.
- The benchmark capacity decreases to 80-93 flights per hour in Marginal conditions and to 60-71 flights per hour in IFR conditions. Throughput may be less when ceiling and visibility are low, or when a less-favorable runway configuration is in use.
- Note that these benchmarks represent balanced operations. Greater throughput may be possible during arrival or departure peaks.
- Planned improvements at BWI include CEFR, which, during Marginal conditions, will allow the use of visual separation by suitably equipped aircraft. However, BWI currently uses visual procedures in Marginal conditions, and therefore the benefit of CEFR will be minimal.
- Although an additional runway at BWI has been mentioned in the past, there are no known plans to construct such a runway at this time. No new runway at BWI was listed in OEP v5.0, and therefore no new runway has been included in this analysis.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

BALTIMORE – Baltimore/Washington International Airport (BWI)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 33L, 33R Departures on 28, 33R *Frequency of Use: Insufficient data; facility reported configuration*	Visual approaches, visual separation	**106-120**
Ceiling and visibility above minima for visual approaches (2500 ft ceiling and 5 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 85%	**Planned improvements (2013)**	Same		**106**
Marginal Rate	**Today**	Arrivals on Runways 10, 15L Departures on 15L, 15R *Frequency of Use: Insufficient data; facility reported configuration*	Visual approaches, visual separation	**80-93**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 6%	**Planned improvements (2013)**	Same		**93**
IFR Rate	**Today**	Arrivals on Runways 10, 15L Departures on 15L, 15R *Frequency of Use: Insufficient data; facility reported configuration*	Instrument approaches, radar separation	**60-71**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 9%	**Planned improvements (2013)**	Same		**71**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

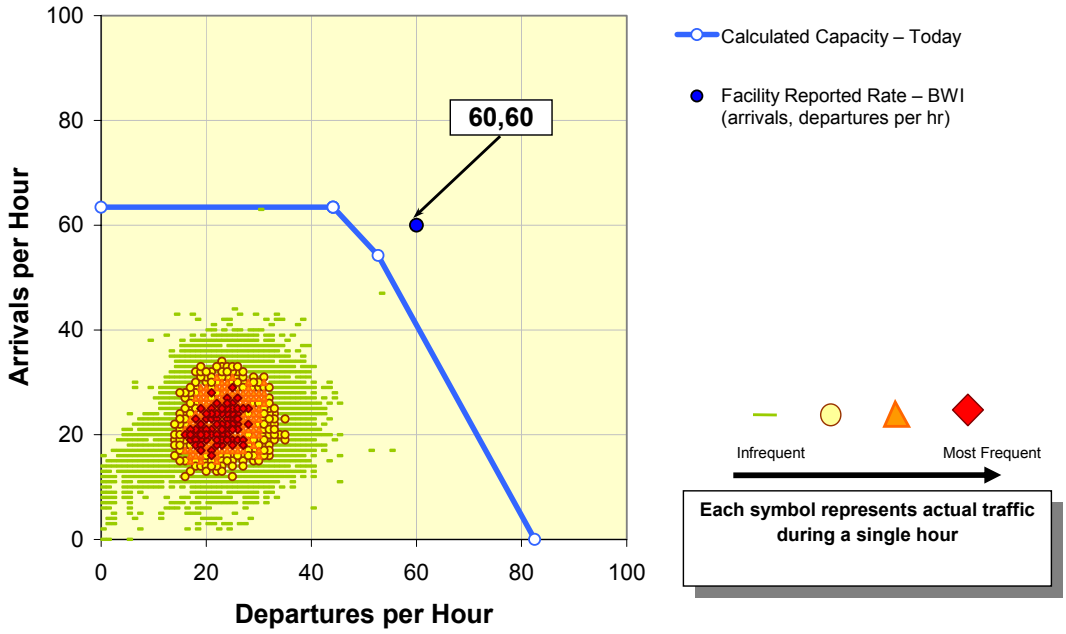
Planned Improvements at BWI include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.

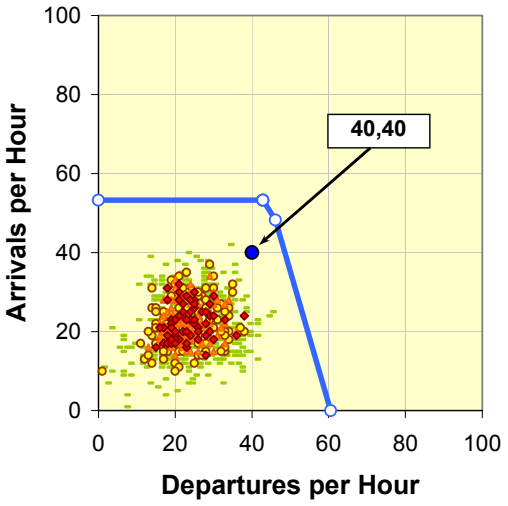
Additional information on this improvement may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

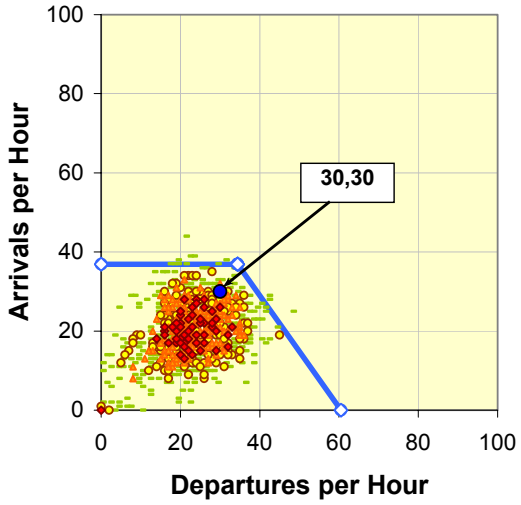
Optimum Rate



Marginal Rate

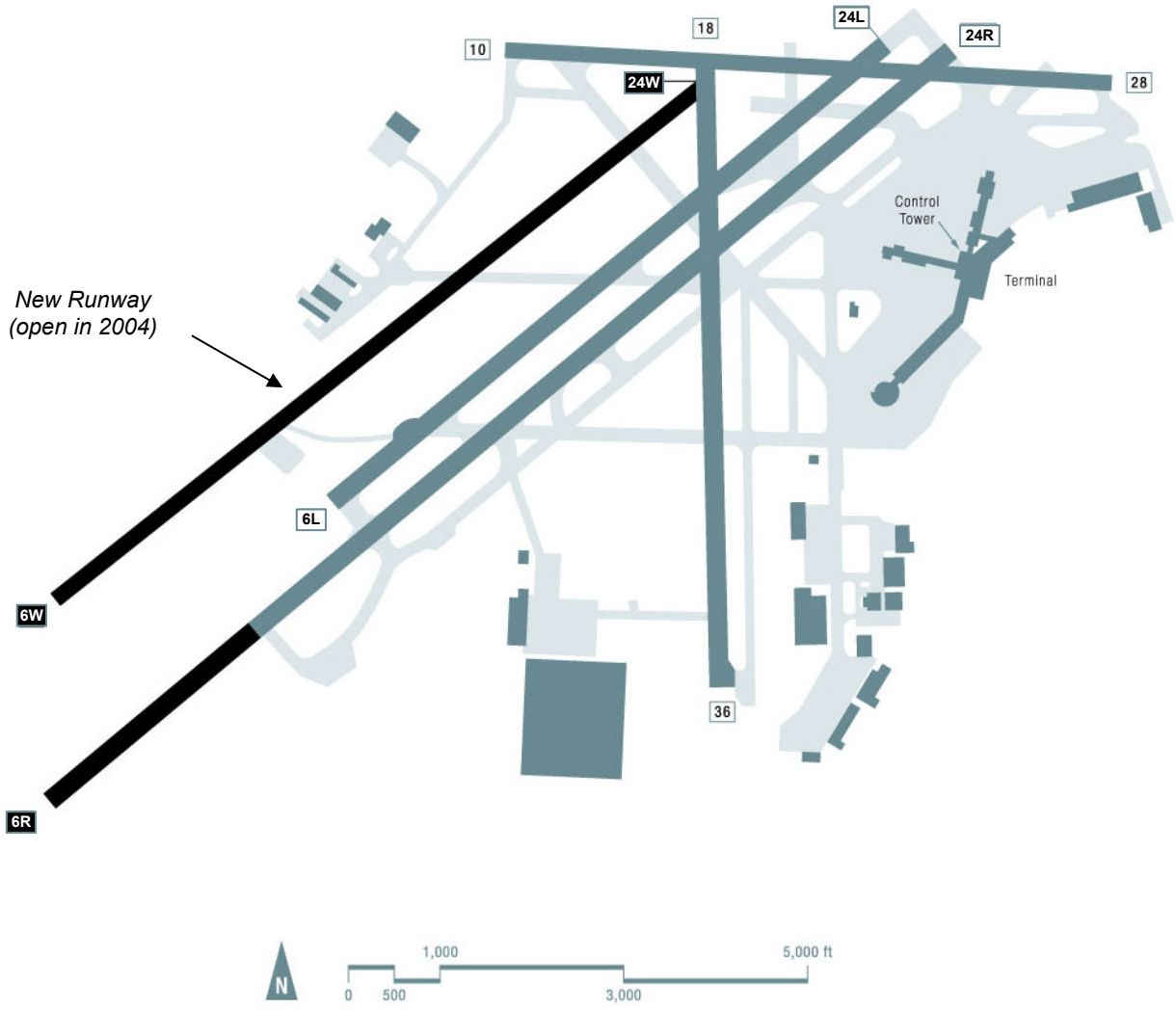


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at BWI.

CLEVELAND – Cleveland Hopkins International (CLE)



Note: *Runway 18/36 at CLE has been decommissioned.*

Benchmark Results

- The current capacity benchmark for Cleveland Hopkins International Airport is 80 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark decreases slightly to 72-77 flights per hour in marginal conditions, and to 64 flights per hour in instrument conditions, for the most commonly used runway configuration in these conditions. Throughput may be less when wind conditions force the use of other configurations, such as single runway operations on Runway 28.
- Additional analysis suggests that these modeled IFR benchmark rates may be too conservative. Operational analysis has indicated that a rate of 90 arrivals and departures per hour is possible under certain IFR conditions.
- Note that these benchmarks do not always represent balanced operations – there may be more departures than arrivals. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- A new parallel runway (6L/24R, shown in the diagram as 6W/24W) spaced 1241 ft from current Runway 6R/24L will be constructed in two stages. Stage 1 is a new 7145 ft runway with CAT I ILS approaches on both ends. Stage 2 is an extension of the runway towards the southwest to 9000 feet. Both runway ends will be upgraded to CAT III ILS approaches. Stage 1 was commissioned in December 2002 and Stage 2 will be completed in November 2004.
- New runway 6L/24R will affect the benchmark rates for CLE. A Precision Runway Monitor (PRM) is also planned, which will allow Simultaneous Offset Instrument Approach (SOIA) operations on the parallel runways. SOIA operations will be conducted during periods of Optimum and Marginal conditions. This assumes that airspace, ground infrastructure, and environmental constraints allow the planned use of the new runway.
- Due to the close spacing of the new runway and existing runways, CLE will continue to operate a single arrival stream and a single departure stream during IFR conditions.
- In addition, technology and procedural improvements (aside from SOIA using PRM) are expected to increase the maximum arrival capacity at CLE over the next 10 years, but will not affect the benchmark rate (for equal numbers of arrivals and departures).
- In the following charts, please note that a number of hourly traffic points fall outside the calculated capacity curves at CLE. There are many possible reasons why this may occur without affecting operational safety. Actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

CLEVELAND – Cleveland Hopkins International Airport (CLE)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runway 24L Departures on 24R *Frequency of Use: 64% in optimum conditions*	Visual approaches, visual separation	**80**
Ceiling and visibility above minima for visual approaches (2600 ft ceiling and 3 mi visibility)	**New Runway (2004)**	Arrivals on Runways 24R, 24L Departures on 24R, 24L		**115**
Occurrence: 78%	**Planned improvements (2013), including new runway**	Same		**115**
Marginal Rate	**Today**	Arrivals on Runway 24L Departures on 24R *Frequency of Use: 64% in marginal conditions*	Instrument approaches, visual separation	**72-77**
Below visual approach minima but better than instrument conditions	**New Runway (2004)**	Arrivals on Runways 24R, 24L Departures on 24R, 24L *Includes SOIA*		**115**
Occurrence: 12%	**Planned improvements (2013), including new runway**	Same	Visual approaches, visual separation	**115**
IFR Rate	**Today**	Arrivals on Runway 6R Departures on 6L *Frequency of Use: 46% in IFR conditions*	Instrument approaches, radar separation	**64**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway (2004)**	Same		**88**
Occurrence: 10%	**Planned improvements (2013), including new runway**	Same		**88**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

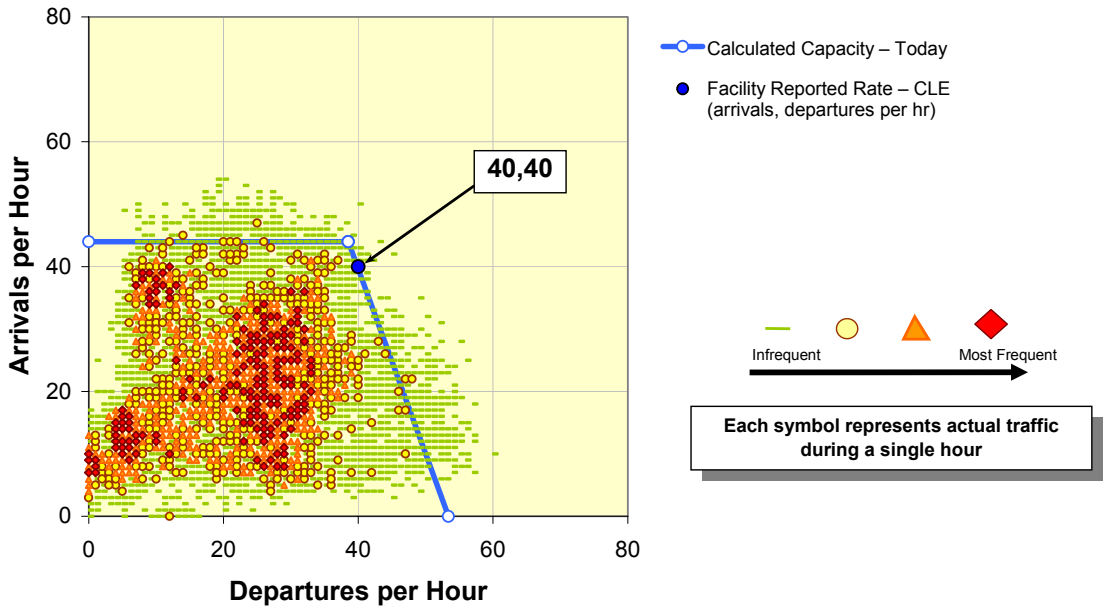
Planned Improvements at CLE include:

- Paired approaches to the planned new runway and current Runway 24L, using SOIA procedures with PRM or using RPAT procedures.
- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Revised wake vortex procedures, to increase arrival and departure throughput on closely spaced parallel runways.

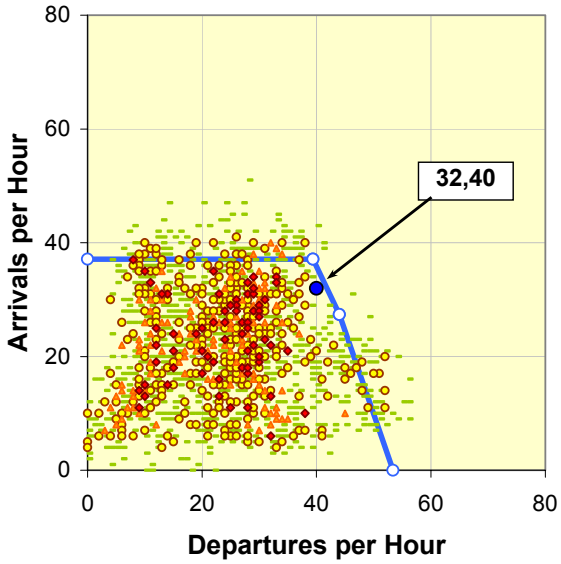
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

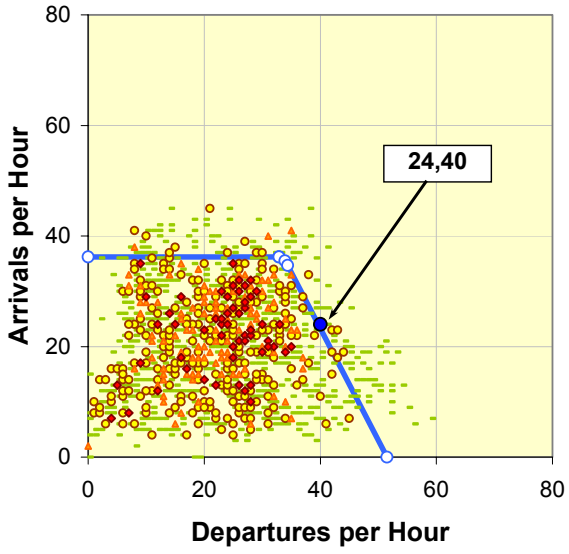
Optimum Rate



Marginal Rate



IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at CLE.

CHARLOTTE – Charlotte/Douglas International (CLT)

Benchmark Results

- The current capacity benchmark rate for Charlotte/Douglas International Airport is 130-131 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- According to the runway configuration data, CLT uses the parallel runways 36L and 36R for arrivals and departures 46 percent of the time under good weather conditions. However, the CLT facility reports that typical arrival and departure rates are higher when using Runways 18L, 18R, and 23. Therefore, the benchmark capacity was modeled using this three-runway configuration.
- Under Optimum and Marginal conditions, CLT imposes radar separation at the outer marker while maintaining visual separation at the threshold.
- The benchmark rate in Marginal conditions is 125-131 flights per hour, and falls to 102-110 flights per hour in IFR conditions for the most commonly used runway configuration in these conditions.
- Note that these benchmarks do not always represent balanced operations – there may be more arrivals than departures. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- The benefit of the planned technological improvements at CLT in Marginal conditions assumes that all arrivals can use CEFR to maintain visual separations, thus allowing the airport to realize greater arrival capacity in Marginal conditions.
- A new runway is being planned for CLT, but planning was not sufficiently advanced to include this runway in OEP v5.0. Therefore, this new runway was not included in this analysis.
- The following charts compare actual hourly traffic with the calculated capacity curves for CLT.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

CHARLOTTE – Charlotte/Douglas International Airport (CLT)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 23, 18R Departures on 18L,18R *Frequency of Use: 44% in optimum conditions*	Visual approaches, radar separation	**130-131**
Ceiling and visibility above minima for visual approaches (3600 ft ceiling and 5 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 82%	**Planned improvements (2013)**	Same		**131**
Marginal Rate	**Today**	Arrivals on Runways 23, 18R Departures on 18L, 18R *Frequency of Use: 51% in marginal conditions*	Instrument approaches, radar separation	**125-131**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 9%	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**131**
IFR Rate	**Today**	Arrivals on Runways 36L, 36R Departures on 36L, 36R *Frequency of Use: 64% in IFR conditions*	Instrument approaches, radar separation	**102-110**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 9%	**Planned improvements (2013)**	Same		**102**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

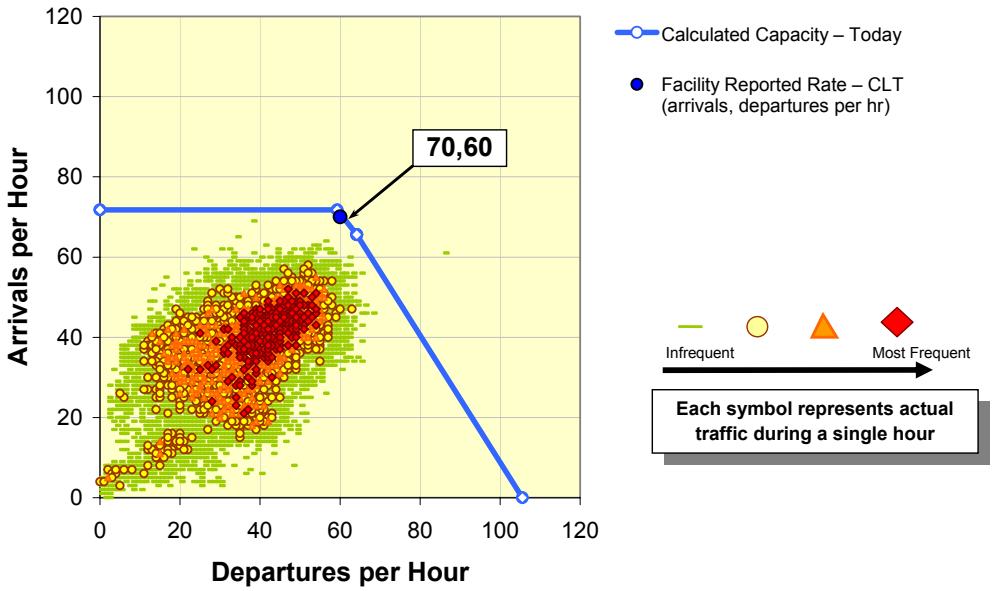
Planned Improvements at CLT include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- A third parallel runway has been proposed for CLT; however it has not yet been approved by the FAA, and thus is not included in this benchmark report.

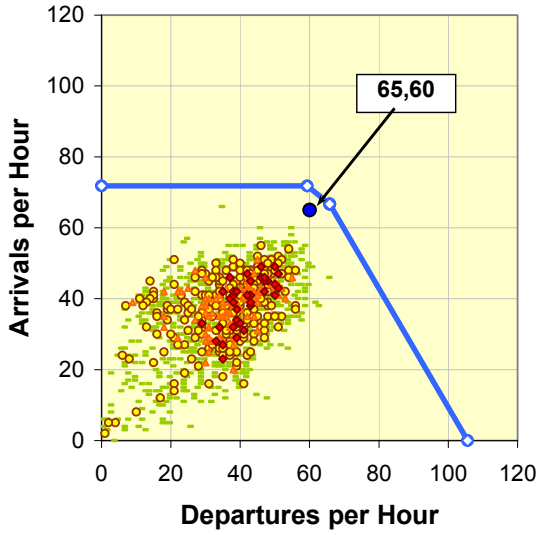
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

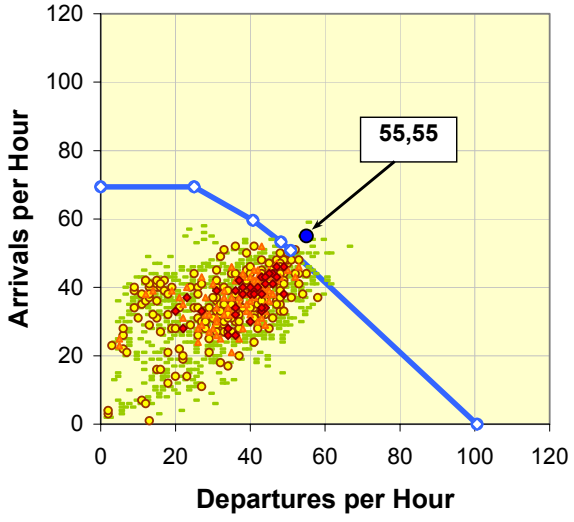
Optimum Rate



Marginal Rate

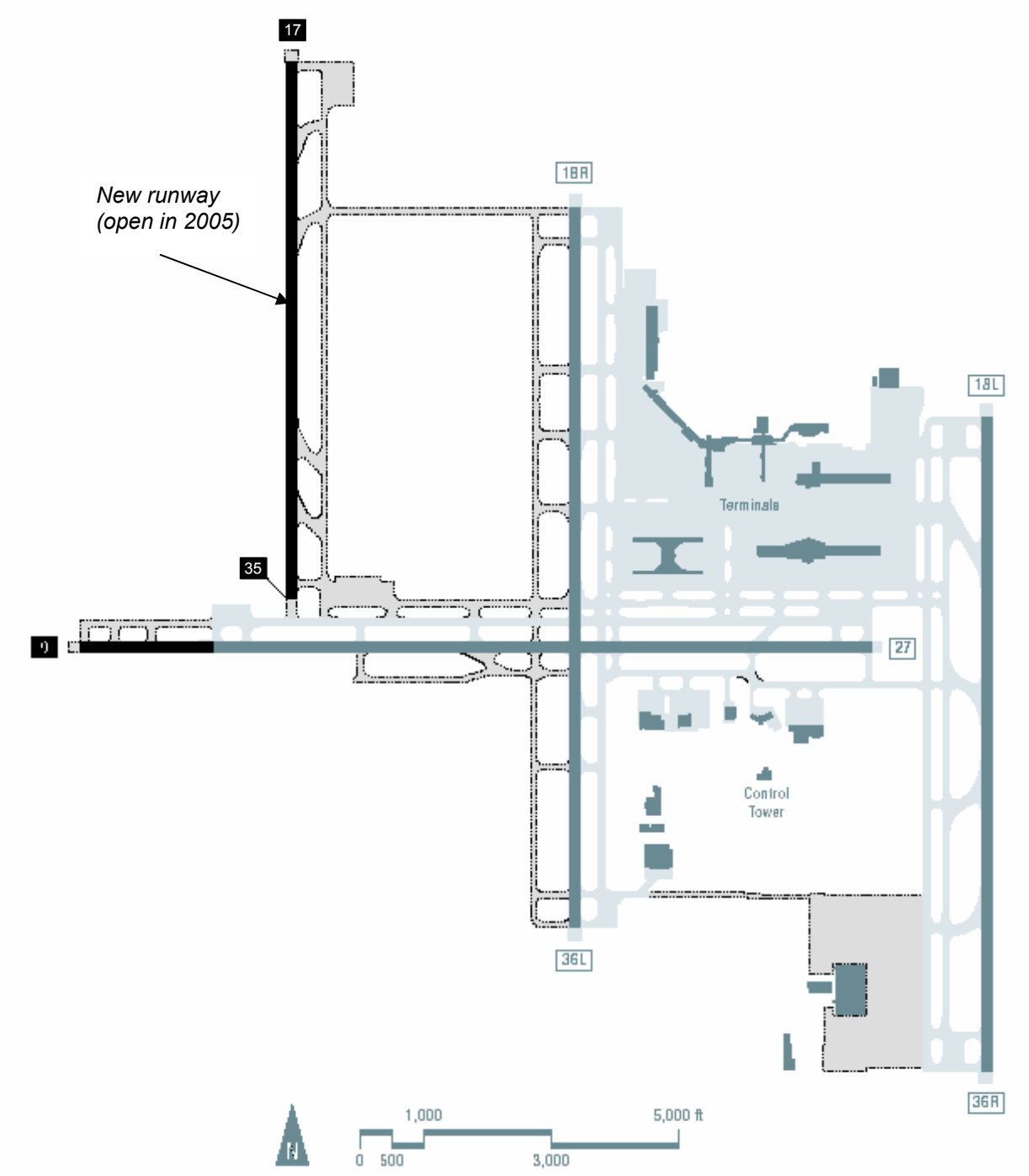


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at CLT.

CINCINNATI – Cincinnati/Northern Kentucky International (CVG)



Benchmark Results

- The capacity benchmark for Cincinnati/Northern Kentucky International Airport today is 120-125 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark rate decreases slightly to 120-124 flights per hour in Marginal conditions, and to 102-120 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low or adverse winds force the use of other runway configurations.
- These benchmark rates represent balanced operations, with equal numbers of arrivals and departures per hour. Greater total throughput may be possible during arrival or departure peaks.
- A new runway, planned for completion in 2005, will allow triple simultaneous approaches, increasing the benchmark capacity by 30-35 percent. This increase can occur *only* if ground infrastructure, environmental constraints, and other operational factors allow the planned use of the new runway. The increase in actual operations may be less if airspace restrictions prevent full use of the new runway.
- Other planned technological improvements at CVG would increase the benchmark capacity by 7-9 additional percentage points. This additional benefit derives mainly from improved delivery accuracy that is assumed to result from advanced TMA and RNAV procedures. Another planned improvement, CEFR, will allow visual separations for suitably equipped aircraft in Marginal conditions.
- This increased delivery accuracy, together with the new runway, is also expected to increase throughput during arrival peaks. CEFR will provide a further increase in arrival capacity in Marginal conditions.
- The following charts compare actual hourly traffic with the calculated capacity curves for CVG. A few points lie outside the capacity curves. There are many possible reasons why this may occur without affecting operational safety. Efficient aircraft sequencing or above-average pilot and controller performance can contribute to higher throughputs. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

CINCINNATI – Cincinnati/Northern Kentucky International Airport (CVG)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 18L, 18R Departures on 18L, 18R, 27 *Frequency of Use: 79% in Optimum conditions*	Visual approaches, visual separation	**120-125**
Ceiling and visibility above minima for visual approaches (2900 ft ceiling and 3 mi visibility)	**New Runway (2005)**	Arrivals on Runways 18L, 18R, 17 Departures on 18L, 18R, 27	Same, with triple simultaneous visual approaches	**168**
Occurrence: 55%	**Planned improvements (2013), including new runway**	Same		**176**
Marginal Rate	**Today**	Arrivals on Runways 18L, 18R Departures on 18L, 18R, 27 *Frequency of Use: 75% in Marginal conditions*	Instrument approaches, visual separation	**120-124**
Below visual approach minima but better than instrument conditions	**New Runway (2005)**	Arrivals on Runways 18L, 18R, 17 Departures on 18L, 18R, 27	Same, with triple simultaneous instrument approaches	**166**
Occurrence: 35%	**Planned improvements (2013), including new runway**	Same	Triple simultaneous visual approaches, visual separation	**176**
IFR Rate	**Today**	Arrivals on Runways 18L, 18R Departures on 18L, 18R *Frequency of Use: 63% in IFR conditions*	Instrument approaches, radar separation	**102-120**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway (2005)**	Arrivals on Runways 18L, 18R, 17 Departures on 18L, 18R, 27	Same, with triple simultaneous instrument approaches	**132**
Occurrence: 10%	**Planned improvements (2013), including new runway**	Same		**141**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

Full operational use of the new parallel runway will require digital controller displays (but not PRM) to enable triple simultaneous instrument approaches, and an airspace redesign to deliver aircraft efficiently to the approaches.

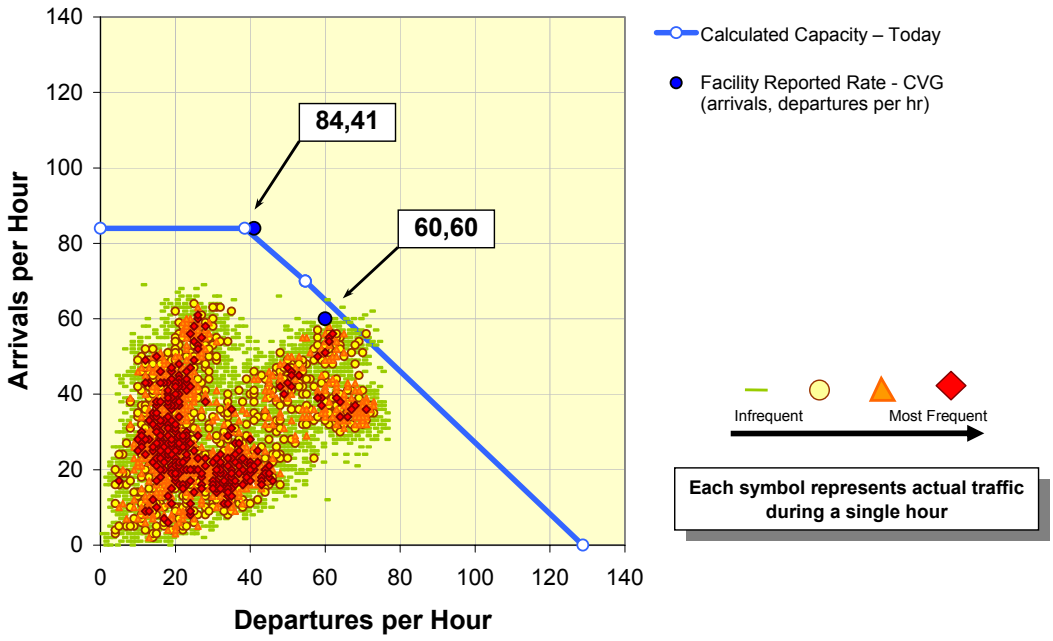
Other planned Improvements at CVG include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Advanced TMA/RNAV, to improve delivery accuracy and help CVG consistently utilize available capacity.

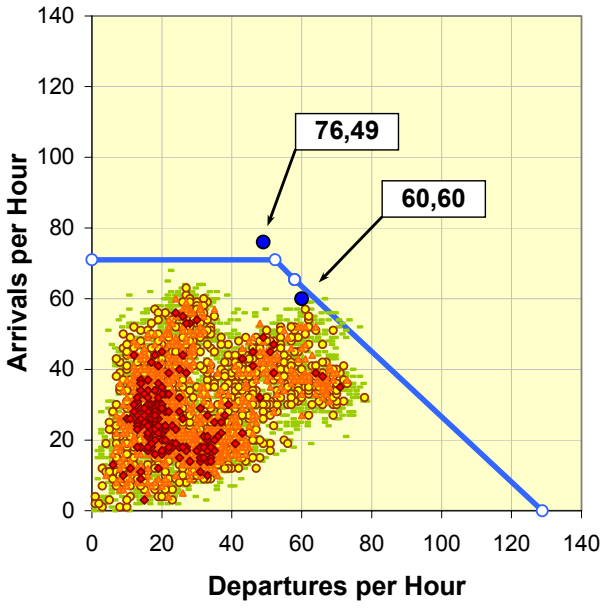
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

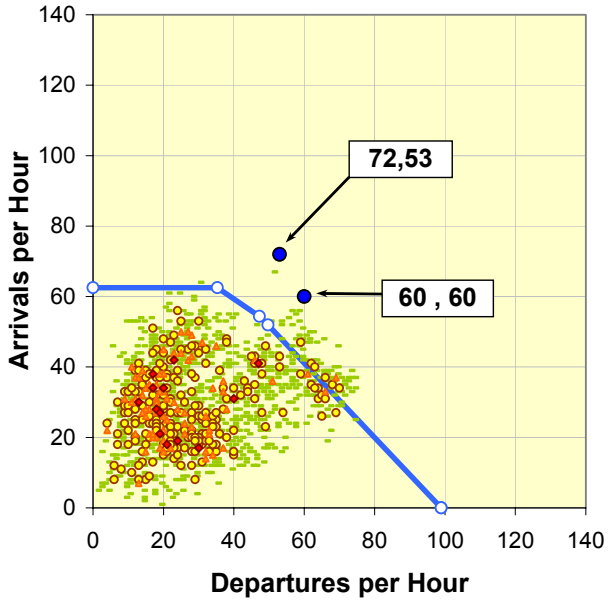
Optimum Rate



Marginal Rate

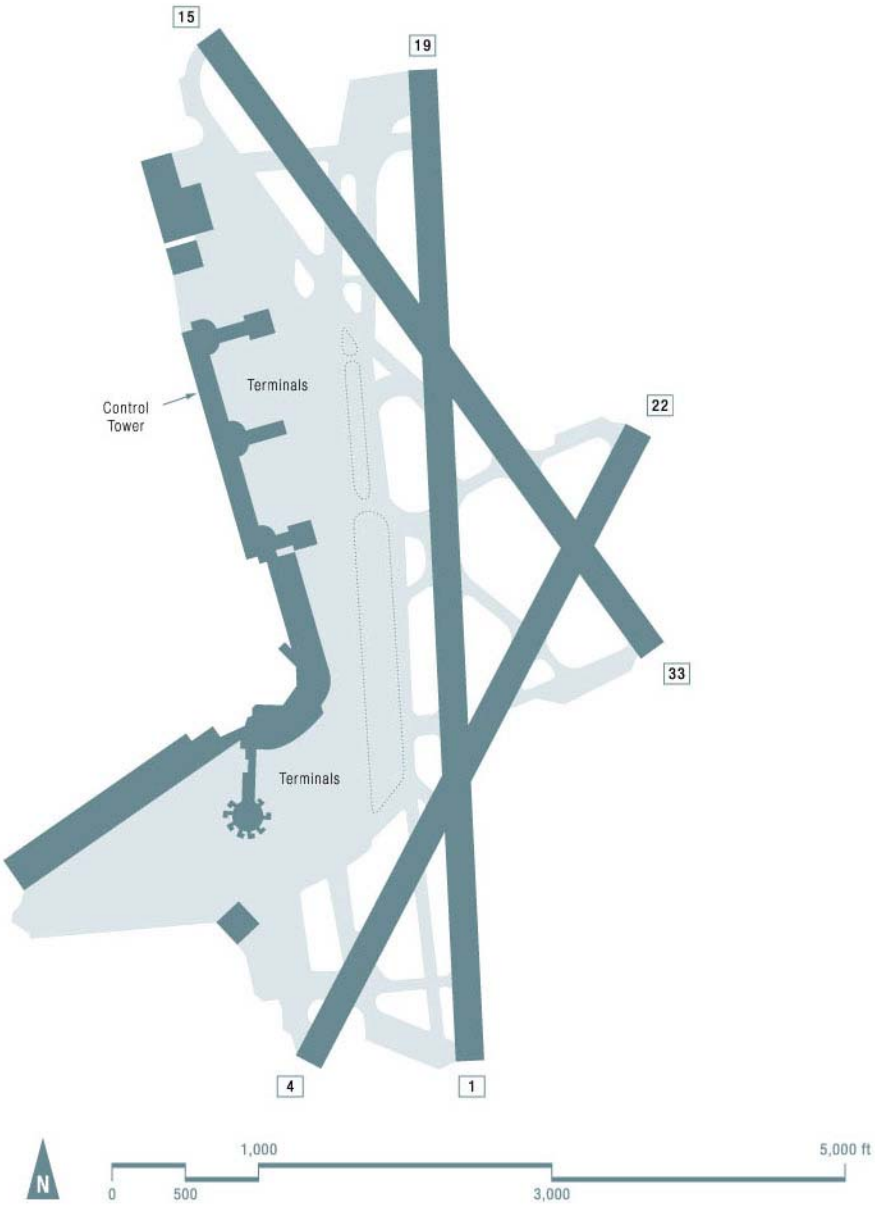


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at CVG.

WASHINGTON – Ronald Reagan Washington National (DCA)



Benchmark Results

- The capacity benchmark for Ronald Reagan Washington National Airport today is 72-87 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark rate decreases to 60-84 flights per hour in Marginal conditions, and to 48-70 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, or if adverse winds force the use of other runway configurations.
- These benchmarks represent balanced operations with equal numbers of arrivals and departures per hour. Greater total throughput may be possible during arrival or departure peaks.
- DCA has several unique operational characteristics, including visual approaches from the north that follow the Potomac River, a Prohibited Area near the departure end of Runway 01, and stringent security requirements since 11 September 2001. The calculated capacity values for DCA may not reflect all the effects of these characteristics on operation rates.
- A planned improvement, CEFR, will allow visual separation by suitably equipped aircraft in Marginal conditions. However, CEFR is not expected to have a significant effect on the benchmark rates at DCA.
- The following charts compare actual hourly traffic with the calculated capacity curves for DCA. A few points lie outside the capacity curves. There are many possible reasons why this may occur without affecting operational safety. Efficient aircraft sequencing or above-average pilot and controller performance can contribute to higher throughputs. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

WASHINGTON – Ronald Reagan Washington National Airport (DCA)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 19, 15, 22 Departures on 19, 15 *Frequency of Use: 42% in Optimum conditions*	Visual approaches, visual separation	**72-87**
Ceiling and visibility above minima for visual approaches (3000 ft ceiling and 4 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 86%	**Planned improvements (2013)**	Same		**87**
Marginal Rate	**Today**	Arrivals on Runway 01 Departures on 01, 04, 33 *Frequency of Use: 30% in Marginal conditions*	Circling approaches, visual separation	**60-84**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 8%	**Planned improvements (2013)**	Same		**84**
IFR Rate	**Today**	Arrivals on Runway 01 Departures on 01, 04, 33 *Frequency of Use: 40% in IFR conditions*	Instrument approaches, radar separation	**48-70**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 6%	**Planned improvements (2013)**	Same		**70**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

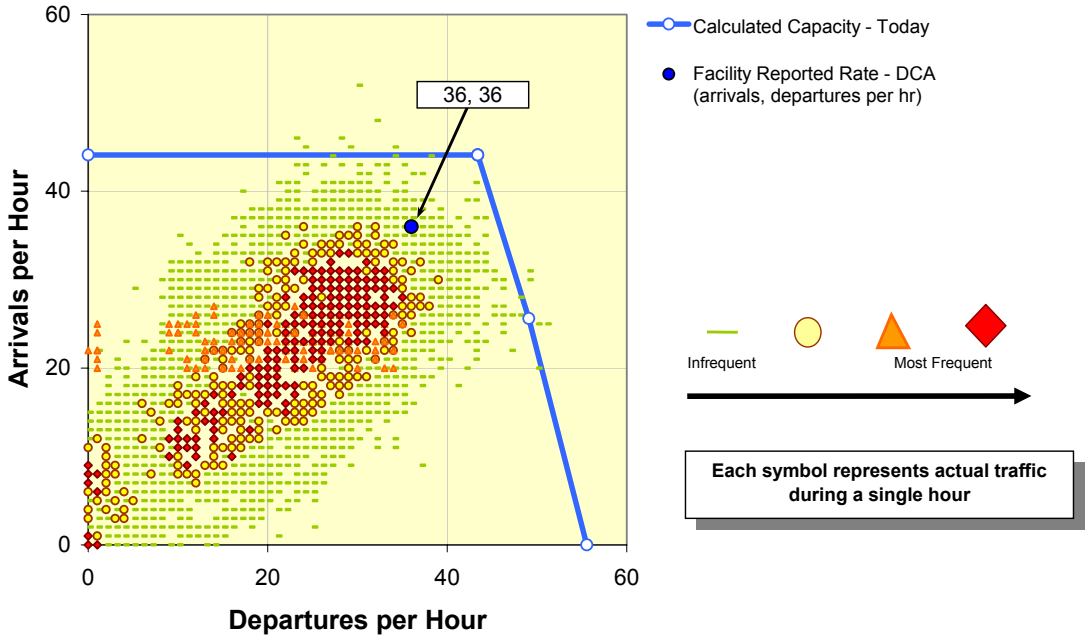
Other Planned Improvements at DCA include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions. However, CEFR does not affect the benchmark rate at DCA due to the type of arrival operations performed.

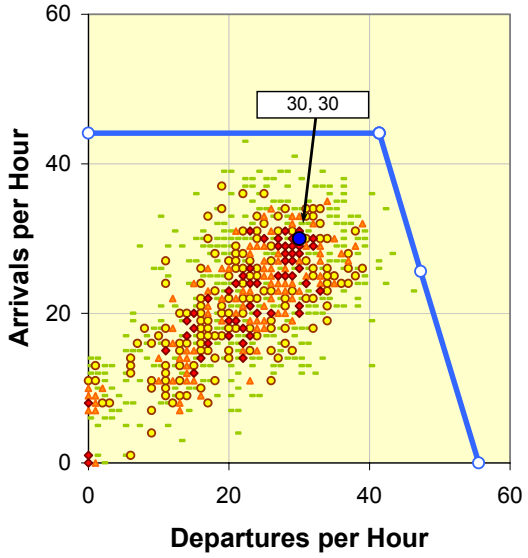
Additional information on this improvement may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

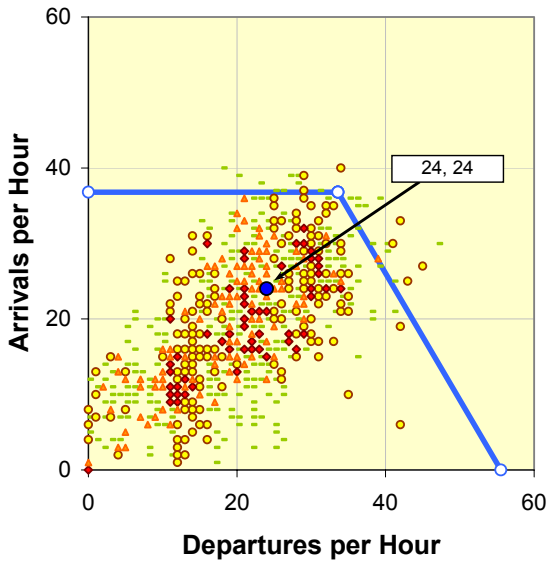
Optimum Rate



Marginal Rate

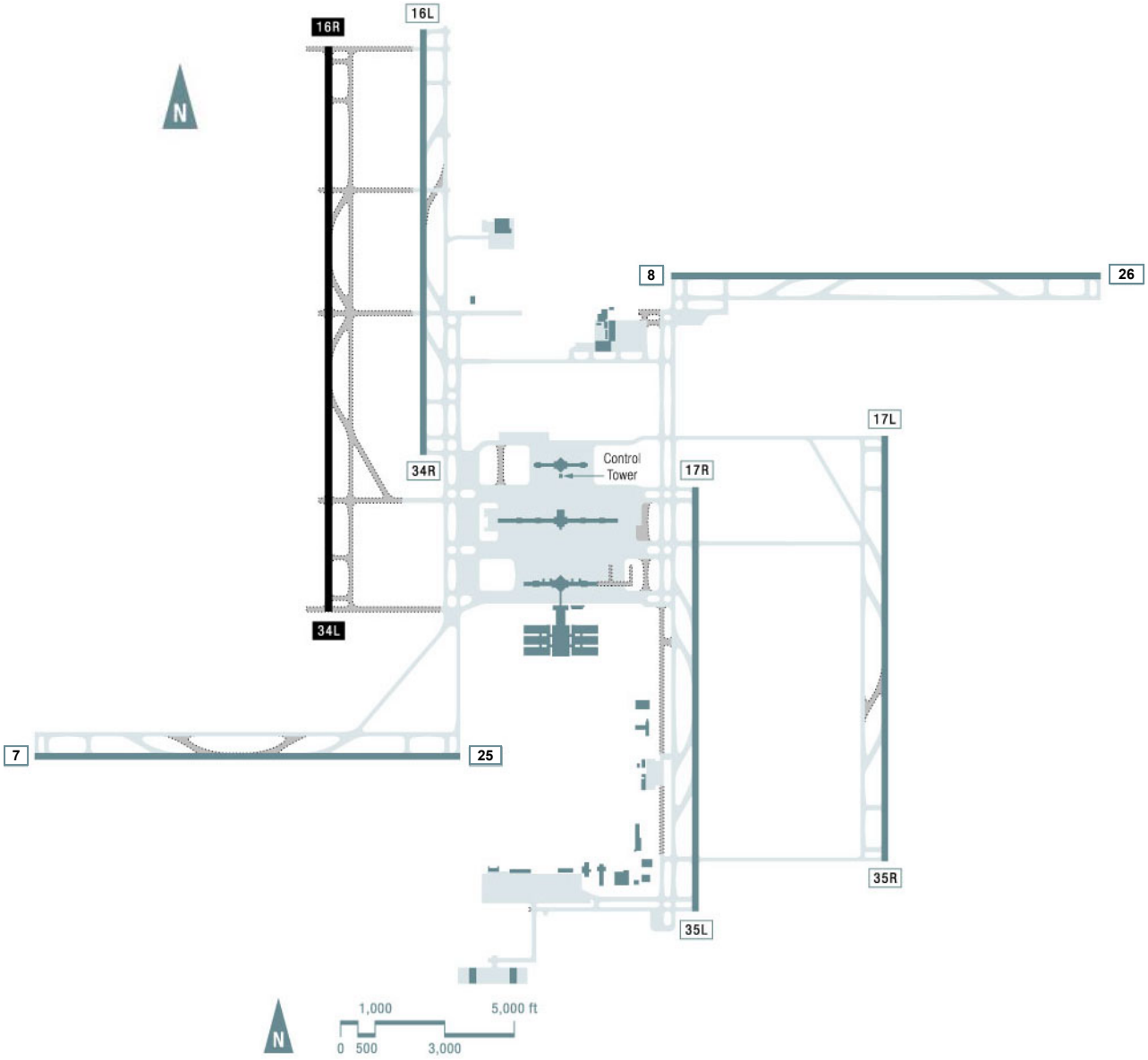


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at DCA.

DENVER – Denver International (DEN)



Benchmark Results

- The capacity benchmark for Denver International Airport today is 210-219 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark decreases to 186-202 flights per hour in Marginal conditions, and to 159-162 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Additional operations may be possible under other conditions, such as additional arrivals on a departure runway. On the other hand, throughput may be less when ceiling and visibility are low, or if adverse winds affect aircraft performance.
- Note that these benchmarks do not always represent balanced operations. Rather, there may be more arrivals than departures in the Optimum and Marginal scenarios, and more departures than arrivals in IFR. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- A new runway opened in 2003, allowing an additional departure stream and increasing the benchmark rate by 22-43 percent depending upon weather conditions. This increase assumes that airspace, air traffic control procedures, ground infrastructure, and environmental constraints allow full use of the new runway.
- Other planned technological improvements at DEN would increase the benchmark rate in all weather conditions. Improved delivery accuracy that is assumed to result from advanced TMA and RNAV procedures will help to increase the benchmark rate in the Optimum and IFR scenarios. The benchmark rate increases further under Marginal conditions with the additional benefit of CEFR, which is expected to allow visual separation by suitably equipped aircraft in Marginal conditions.
- The following charts compare actual hourly traffic with the calculated capacity curves for DEN.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

DENVER – Denver International Airport (DEN)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate Ceiling and visibility above minima for visual approaches (2000 ft ceiling and 3 mi visibility) *Occurrence: 92%*	**Today**	Arrivals on Runways 16, 17R, 7 Departures on 8, 17L *Frequency of Use: Insufficient data; facility reported configuration*	Visual approaches, visual separation	**210-219**
	New Runway (2003)	Arrivals on Runways 16, 17R, 7 Departures on 8, 17L, 16R		**266**
	Planned improvements (2013), including new runway	Arrivals on Runways 34L, 34R, 35L, 35R Departures on 8, 7, 34R, 34L		**281**
Marginal Rate Below visual approach minima but better than instrument conditions *Occurrence: 2%*	**Today**	Arrivals on Runways 35L, 35R, 26 Departures on 25, 34R *Frequency of Use: Insufficient data; facility reported configuration*	Instrument approaches, visual separation	**186-202**
	New Runway (2003)	Arrivals on Runways 35L, 35R, 26 Departures on 25, 34R, 34L		**249**
	Planned improvements (2013), including new runway	Arrivals on Runways 34L, 34R, 35L, 35R Departures on 8, 7, 34R, 34L	Visual approaches, visual separation	**281**
IFR Rate Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles) *Occurrence: 6%*	**Today**	Arrivals on Runways 34R,35L,35R Departures on 25, 34R *Frequency of Use: Insufficient data; facility reported configuration*	Instrument approaches, radar separation	**159-162**
	New Runway (2003)	Arrivals on Runways 34L, 35L, 35R Departures on 25, 34R, 34L		**227**
	Planned improvements (2013), including new runway	Same		**236**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

Full operational use of the new parallel runway will provide an additional departure stream in all weather scenarios.

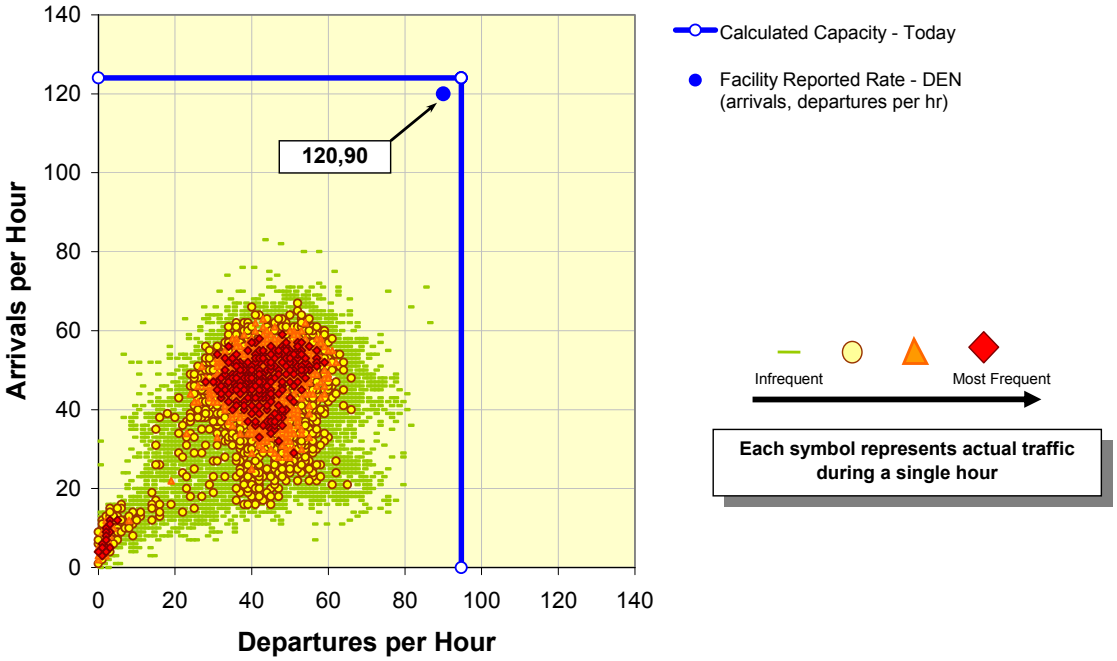
Other planned Improvements at DEN include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Advanced TMA/RNAV, to improve delivery accuracy and help DEN consistently utilize available capacity.

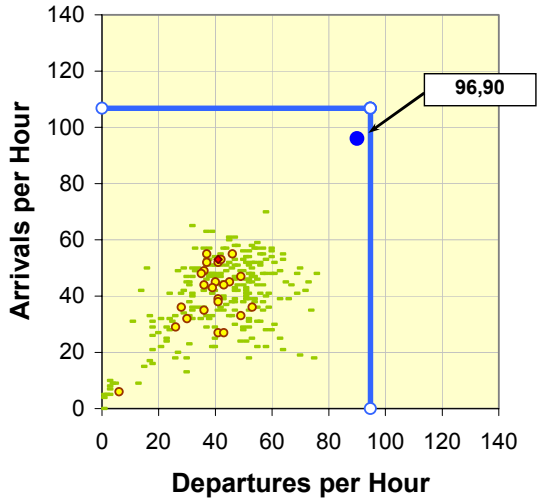
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

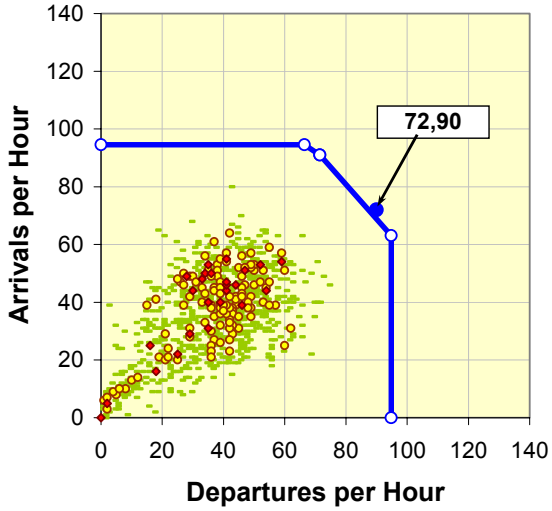
Optimum Rate



Marginal Rate

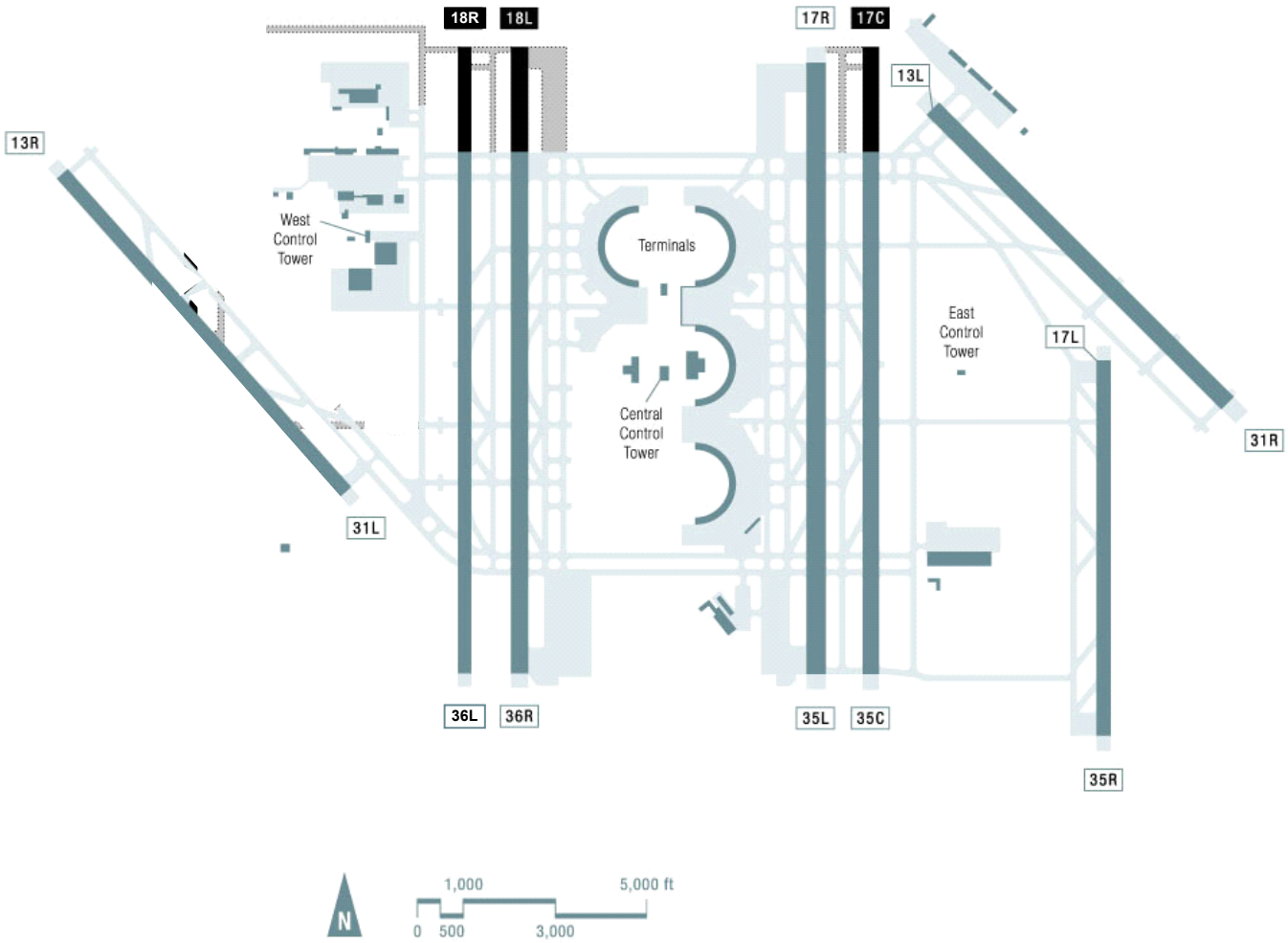


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at DEN.

DALLAS-FORT WORTH – Dallas/Fort Worth International (DFW)



Benchmark Results

- The capacity benchmark for Dallas/Fort Worth International Airport today is 270-279 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark decreases slightly to 231-252 flights per hour in Marginal conditions, and to 186-193 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, or adverse winds force the use of other runway configurations.
- Note that these benchmarks do not always represent balanced operations. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- Other planned technological improvements at DFW would increase the benchmark rate by 6 to 20 percent. This additional benefit derives mainly from improved delivery accuracy that is assumed to result from advanced TMA and RNAV procedures. RNAV departure procedures allow some departures on the parallel runways currently used only for arrivals. Another planned improvement, CEFR, is expected to allow visual separations by suitably equipped aircraft in Marginal conditions.
- The following charts compare actual hourly traffic with the calculated capacity curves for DFW.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

DALLAS-FORT WORTH – Dallas/Fort Worth International Airport (DFW)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 13R,18R,17L/C Departures on 18L, 17R, 13L (props) *Frequency of Use: 71% in Optimum conditions*	Visual approaches, visual separation	**270-279**
Ceiling and visibility above minima for visual approaches (3500 ft ceiling and 5 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 81%	**Planned improvements (2013)**	Same		**303**
Marginal Rate	**Today**	Arrivals on Runways 13R,18R,17L/C Departures on 18L, 17R, 13L (props) *Frequency of Use: 57% in Marginal conditions*	Instrument approaches, visual separation	**231-252**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 13%	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**303**
IFR Rate	**Today**	Arrivals on Runway 18R, 17L, 17C Departures on 18L, 17R, 13L(props) *Frequency of Use: 35% in IFR conditions*	Instrument approaches, radar separation	**186-193**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 6%	**Planned improvements (2013)**	Same		**205**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

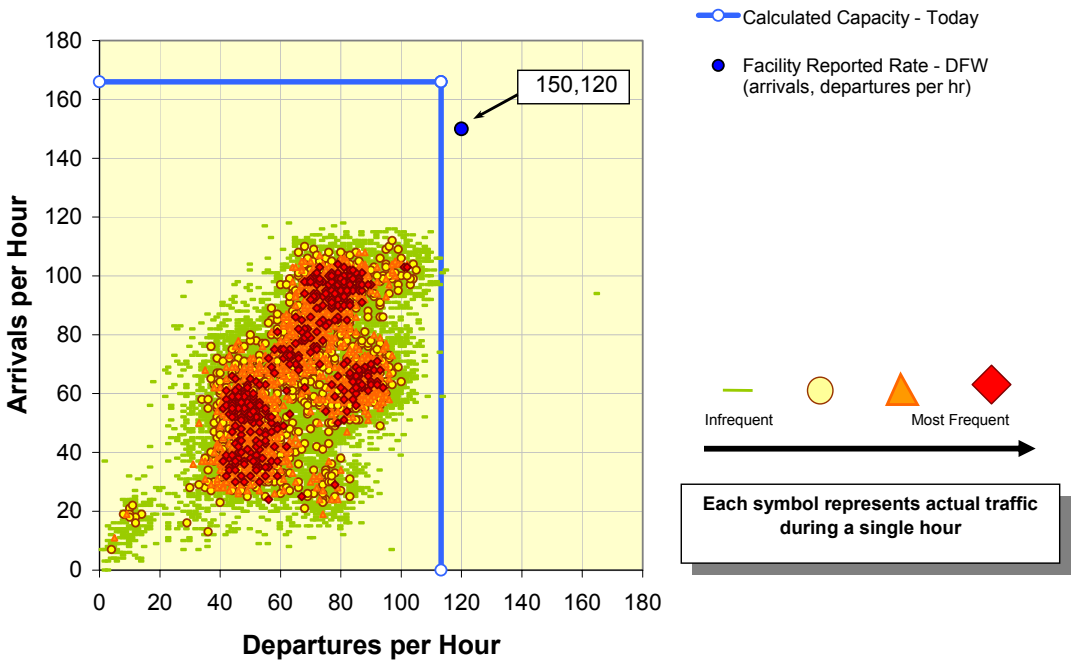
Other planned Improvements at DFW include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Advanced TMA/RNAV, to improve delivery accuracy and help DFW consistently utilize available capacity.
- RNAV departure routes enable jet departures from Runways 18R and 17C to maintain separation from other departures, while remaining outside noise-sensitive areas.

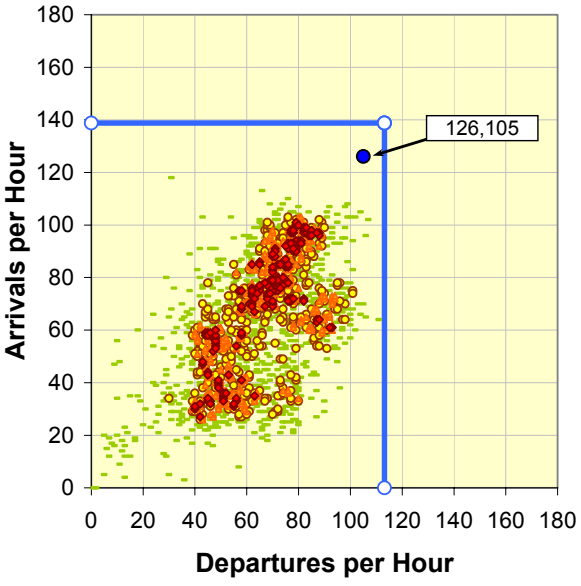
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

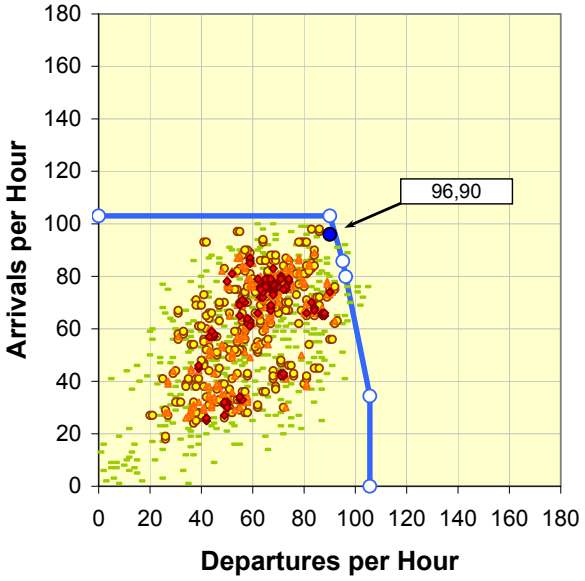
Optimum Rate



Marginal Rate



IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at DFW.

DETROIT – Detroit Metropolitan Wayne County (DTW)

Benchmark Results

- The capacity benchmark for Detroit Metropolitan Wayne County Airport today is 184-189 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark decreases to 168-173 flights per hour in Marginal conditions, and to 136-145 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, or if adverse winds force the use of other runway configurations.
- Note that these benchmark rates do not always represent balanced operations. Rather, there are more departures than arrivals in the Marginal scenario, and more arrivals than departures in the IFR scenario. Also, the benchmarks are not necessarily representative of airport performance during arrival or departure peaks. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- A planned improvement, CEFR, is expected to allow visual separation by suitably equipped aircraft in Marginal conditions. This would enable an increase in peak arrival rates in Marginal conditions.
- The benchmark rates for Marginal and IFR weather are based on arrivals to only two runways, 21L and 22R. The airport would have additional arrival capacity if it were possible to use three runways for arrivals. For example, Runways 22R and 22L (which are separated by 3000 feet) might be used for dependent approaches, while a third independent arrival stream would use Runway 21L. However, procedures for such mixed triple operations do not currently exist, nor are they included in OEP v5.0, and so such operations are not included in these benchmark results.
- The following charts compare actual hourly traffic with the calculated capacity curves for DTW. During busy time periods, DTW will operate close to the capacity curve; this may not be apparent in the charts because the busy periods typically span two separate hours.
- Please note that the new parallel Runway 04L/22R did not open until December 2001 and thus was not operational for much of the time period shown. Also, Runway 03L/21R was closed for maintenance after Runway 04L/22R was opened. Therefore, the historical data in these charts is not representative of the current capabilities of DTW with all runways available.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

DETROIT – Detroit Metropolitan Wayne County Airport (DTW)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 21L, 22L, 22R Departures on 21R, 22L *Frequency of Use: 73% in Optimum conditions*	Visual approaches, visual separation	**184-189**
Ceiling and visibility above minima for visual approaches (3000 ft ceiling and 5 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 74%	**Planned improvements (2013)**	Same		**189**
Marginal Rate	**Today**	Arrivals on Runways 21L, 22R Departures on 21R, 22L *Frequency of Use: 78% in Marginal conditions*	Instrument approaches, visual separation	**168-173**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 16%	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**187**
IFR Rate	**Today**	Arrivals on Runways 21L, 22R Departures on 21R, 22L *Frequency of Use: 61% in IFR conditions*	Instrument approaches, radar separation	**136-145**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 10%	**Planned improvements (2013)**	Same		**145**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

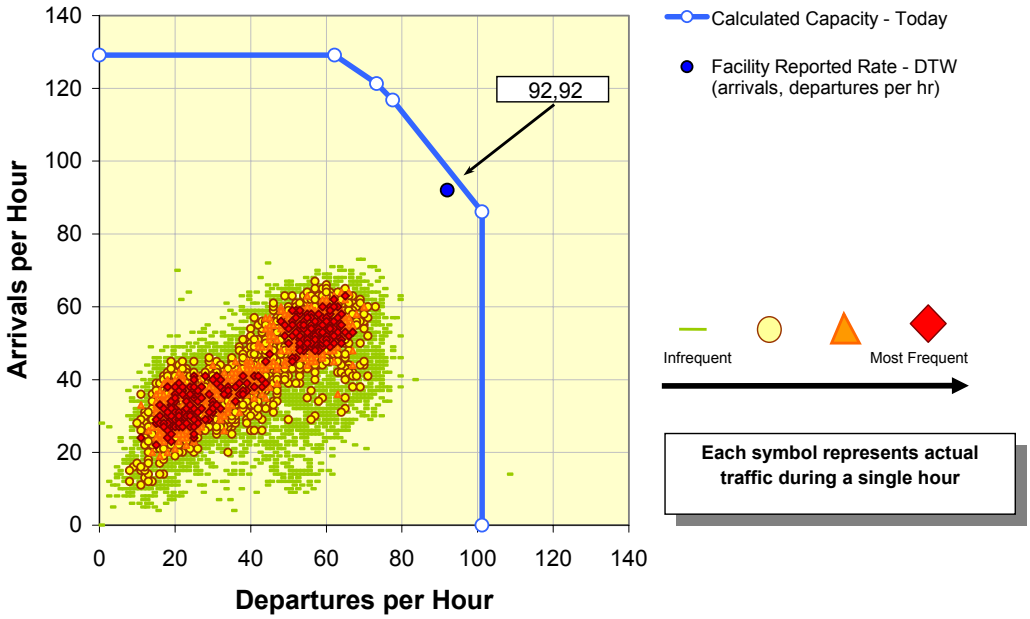
Planned Improvements at DTW include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.

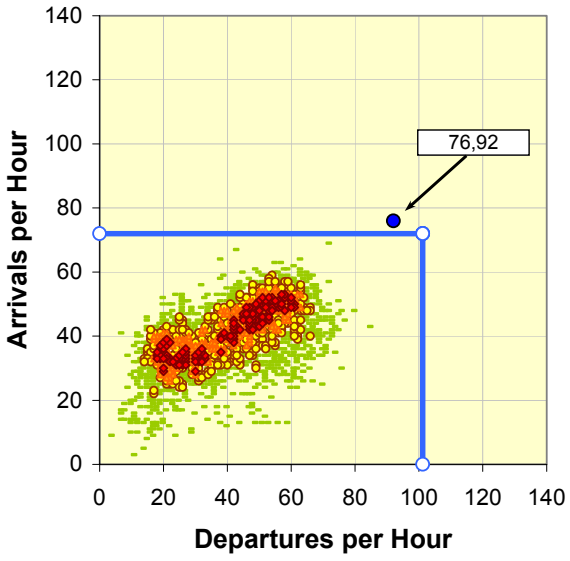
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

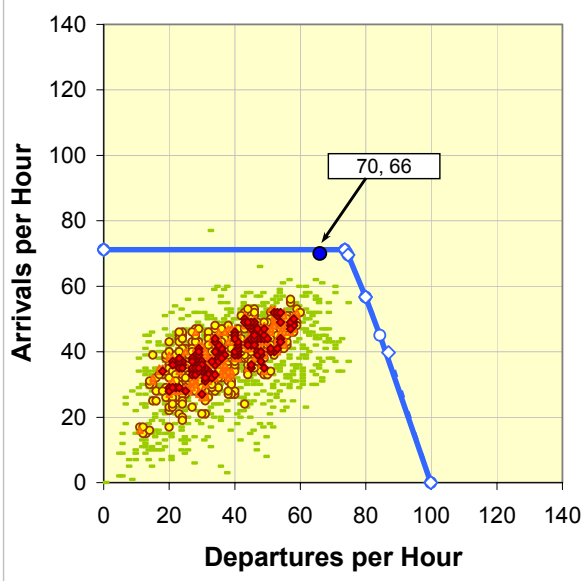
Optimum Rate



Marginal Rate

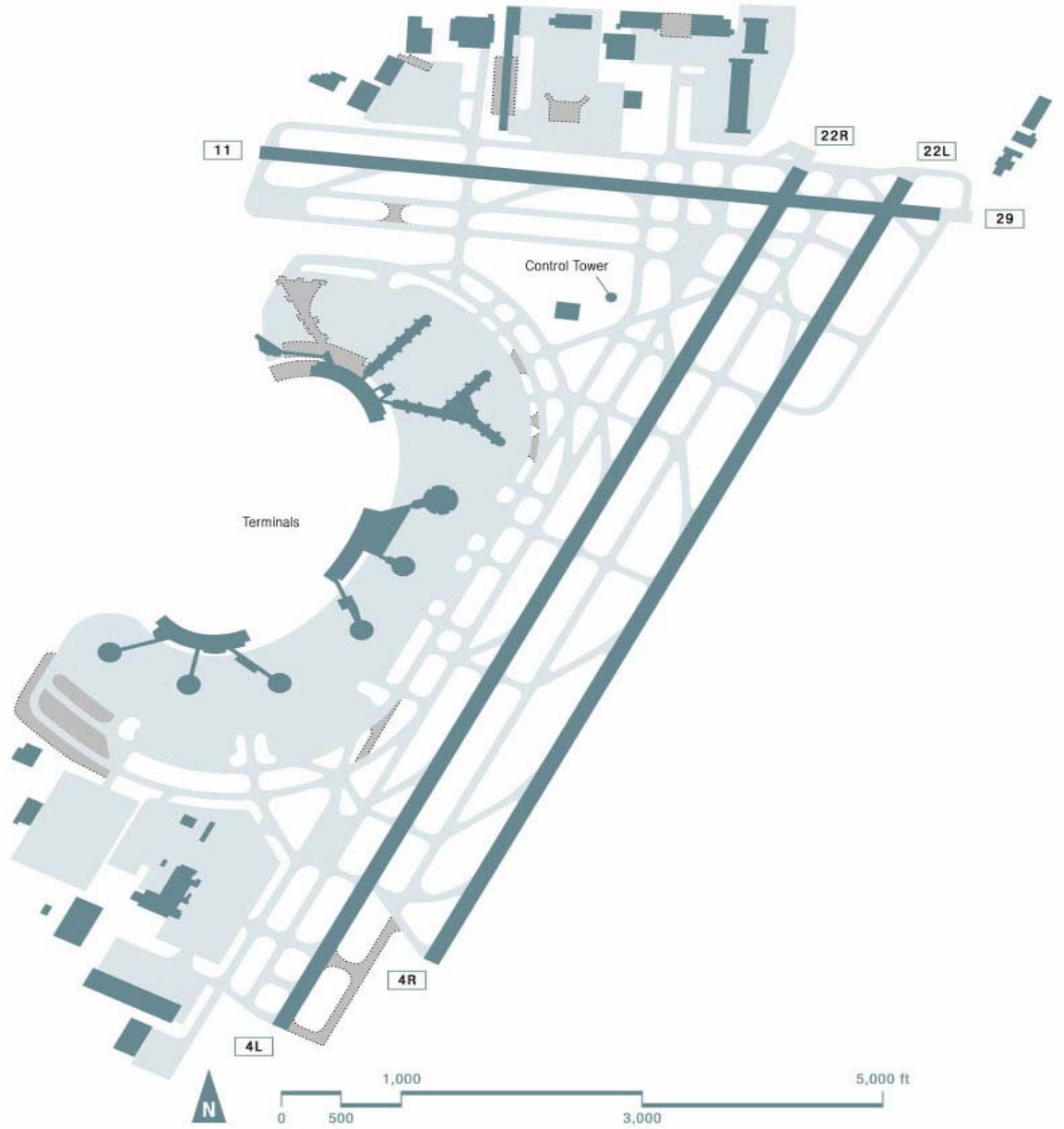


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at DTW.

NEWARK – Newark Liberty International (EWR)



Benchmark Results

- The capacity benchmark for Newark Liberty International Airport today is 84-92 flights per hour (arrivals and departures) in Optimum weather.
- The benchmark rate decreases to 80-81 flights per hour in Marginal conditions and to 61-66 flights per hour in IFR conditions.
- Note that these benchmarks represent balanced operations. Greater throughput may be possible during arrival or departure peaks.
- The most common runway configuration used in Optimum conditions today is arrivals on Runway 22L with occasional arrivals on Runway 11, and departures on Runway 22R with occasional departures on Runway 29.
- For future capacity benchmark calculations, the configuration yielding the best capacity in the Optimum and Marginal scenarios was usage of the parallels, i.e., arrivals on Runways 4L and 4R with departures on Runway 4L. The usage of this configuration assumes an airspace redesign and paired approaches in Marginal conditions based on either SOIA or RPAT procedures.
- In the following charts, please note that a number of hourly traffic points fall outside the calculated capacity curves at EWR. There are many possible reasons why this may occur without affecting operational safety. Higher throughputs may be possible when more than the average number of flights can use the secondary runway 11/29. Also, higher throughputs may be enabled by more efficient sequencing of aircraft, or by better than average pilot and controller performance. Lastly, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

NEWARK – Newark Liberty International Airport (EWR)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runway 22L (and 11) Departures on 22R (and 29) *Frequency of Use: 57% in Optimum conditions*	Visual approaches, visual separation	**84-92**
Ceiling and visibility above minima for visual approaches (3000 ft ceiling and 4 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 82%	**Planned improvements (2013)**	Arrivals on Runway 4R, 4L Departures on 4L		**93**
Marginal Rate	**Today**	Arrivals on Runway 4R Departures on 4L *Frequency of Use: 58% in Marginal conditions*	Instrument approaches, visual separation	**80-81**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 9%	**Planned improvements (2013)**	Arrivals on Runway 4R, 4L Departures on 4L	Visual approaches, visual separation	**86**
IFR Rate	**Today**	Arrivals on Runway 4R Departures on 4L *Frequency of Use: 62% in IFR conditions*	Instrument approaches, radar separation	**61-66**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 9%	**Planned improvements (2013)**	Same		**61**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

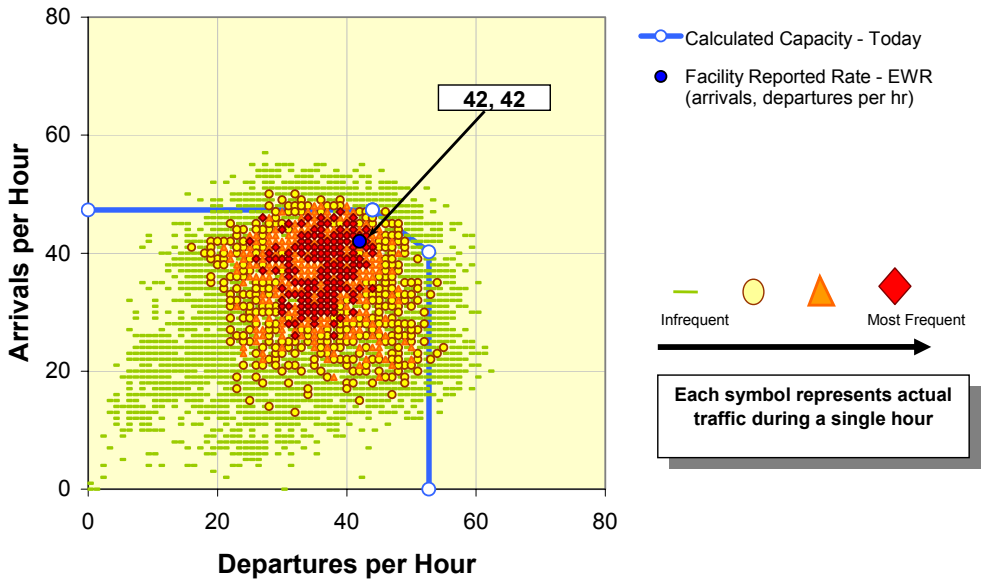
Planned Improvements at EWR include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Utilization of the parallel runways, 4L and 4R, for paired approaches. In Marginal conditions, such approaches might be enabled by SOIA (with PRM) or RPAT procedures.
- Airspace redesign.

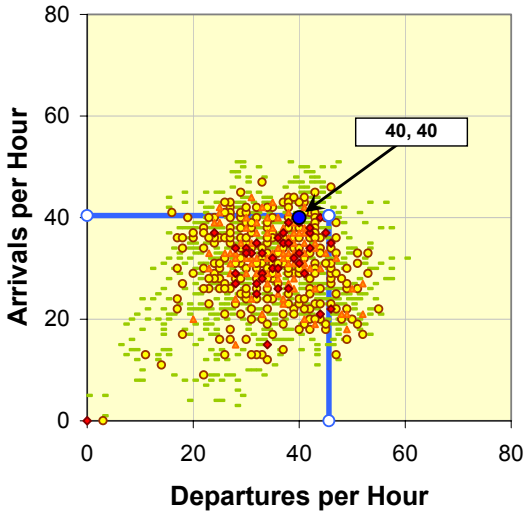
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

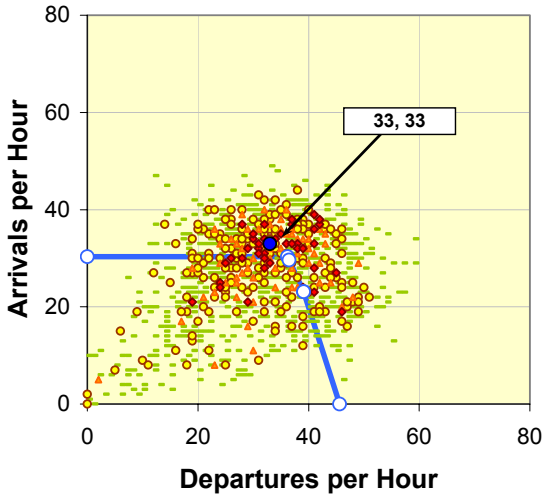
Optimum Rate



Marginal Rate

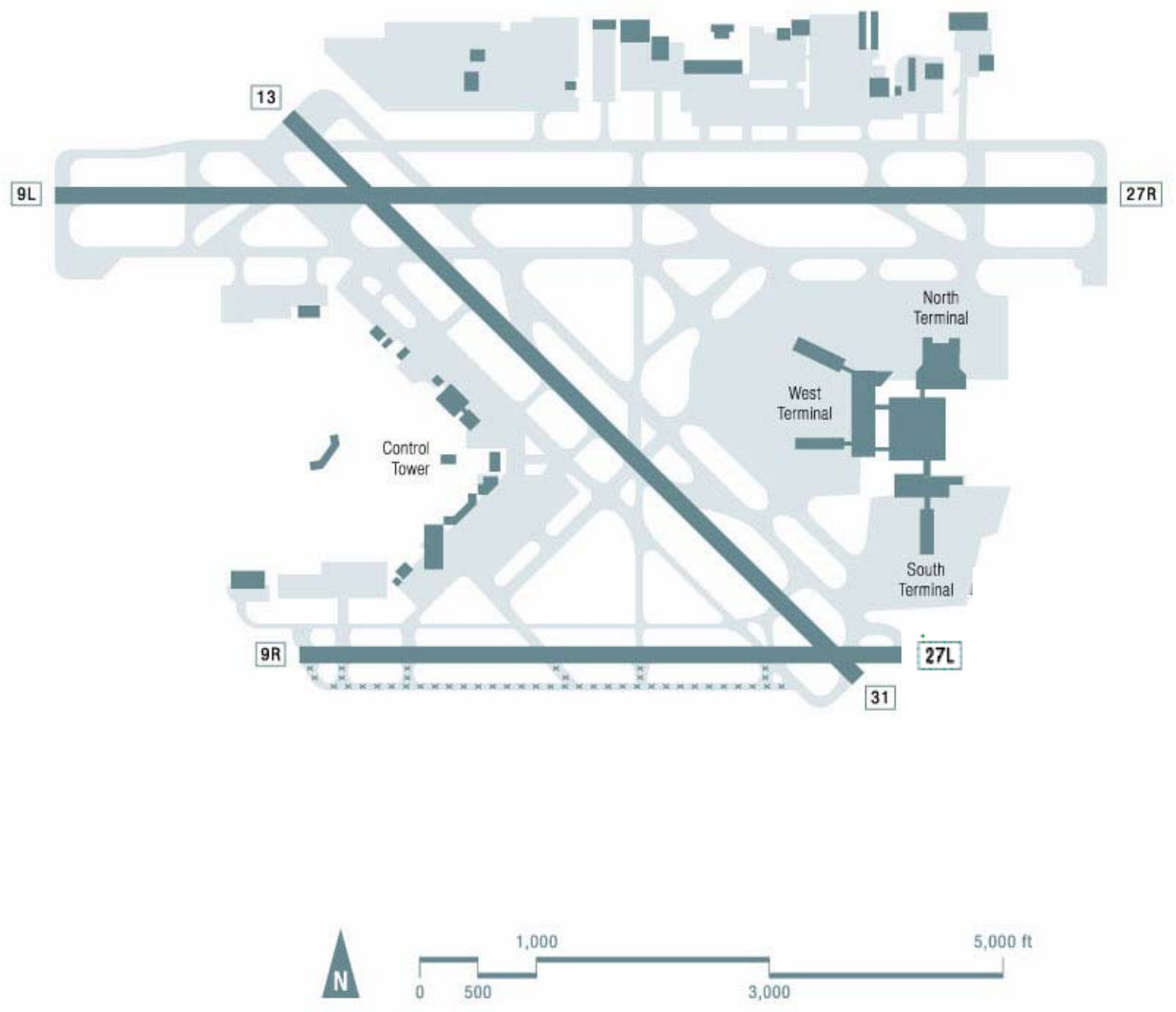


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at EWR.

FORT LAUDERDALE-HOLLYWOOD – Ft. Lauderdale-Hollywood International (FLL)



Benchmark Results

- The capacity benchmark for Ft. Lauderdale-Hollywood International Airport today is 60-62 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted. The benchmark falls slightly to 60-61 flights per hour in Marginal conditions. In both these conditions the use of Runway 9R is limited by aircraft size and weight restrictions to about 10 percent of total operations.
- The benchmark rate falls to 52-56 flights per hour in IFR conditions. However, IFR conditions occur very rarely at FLL.
- Note these benchmarks do not represent balanced operations. Rather, there are fewer arrivals than departures in all three scenarios. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- Planned technological improvements at FLL would increase the arrival peak capacity in Marginal conditions by 30 percent, from 33 to 44 arrivals per hour, although the benchmark rate does not change. The benefit in Marginal conditions assumes that all arrivals can use CEFR to achieve visual separation, thus allowing the airport to achieve the Optimum rate arrival capacity in Marginal conditions.
- Plans are currently underway to extend Runway 9R/27L but the operational concept has not been finalized. Therefore, this potential improvement is not considered in this analysis.
- The following charts compare actual hourly traffic with the calculated capacity curves for FLL. Please note that a few hourly traffic points fall outside the calculated capacity curves. There are many possible reasons why this may occur without affecting operational safety. For example, more aircraft may have been able to use Runway 9R than were assumed in the analysis. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

FORT LAUDERDALE-HOLLYWOOD – Ft. Lauderdale-Hollywood International (FLL)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on 9R, 9L Departures on 9R, 9L *Frequency of Use: 86% in Optimum conditions*	Visual approaches, visual separation	**60-62**
Ceiling and visibility above minima for visual approaches (4000 ft ceiling and 5 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 82%	**Planned improvements (2013)**	Same		**62**
Marginal Rate	**Today**	Arrivals on 9R, 9L Departures on 9R, 9L *Frequency of Use: 85% in Marginal conditions*	Instrument approaches, visual separation	**60-61**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 16%	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**61**
IFR Rate	**Today**	Arrivals on 9L Departures on 9L *Frequency of Use: 77% in IFR conditions*	Instrument approaches, radar separation	**52-56**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 2%	**Planned improvements (2013)**	Same		**52**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

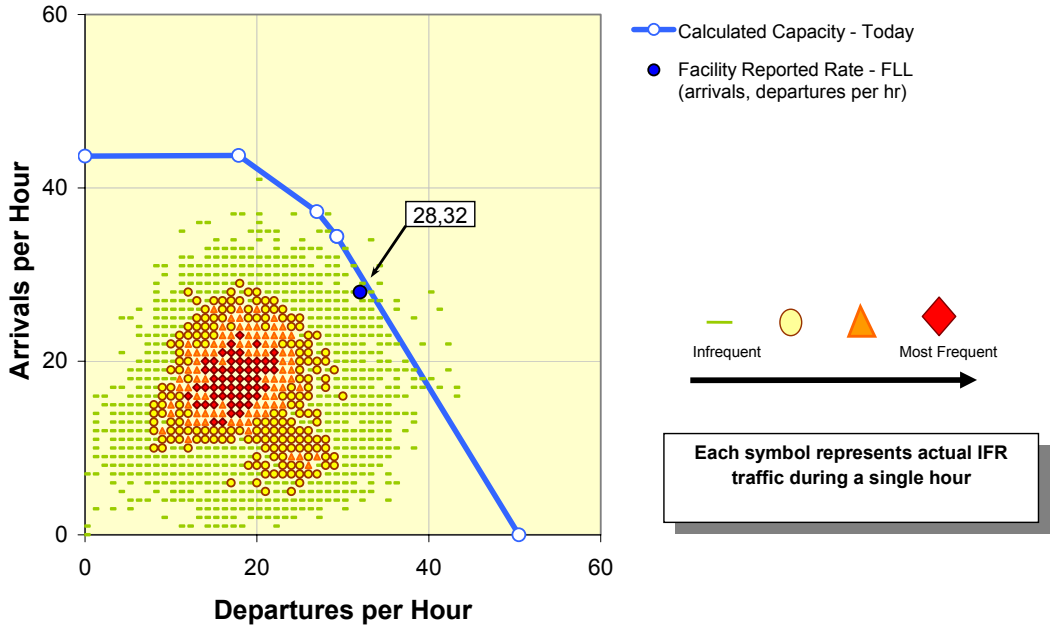
Planned Improvements at FLL include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.

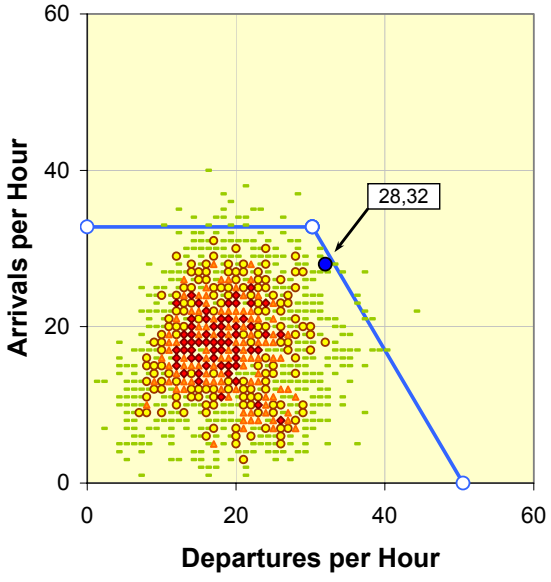
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

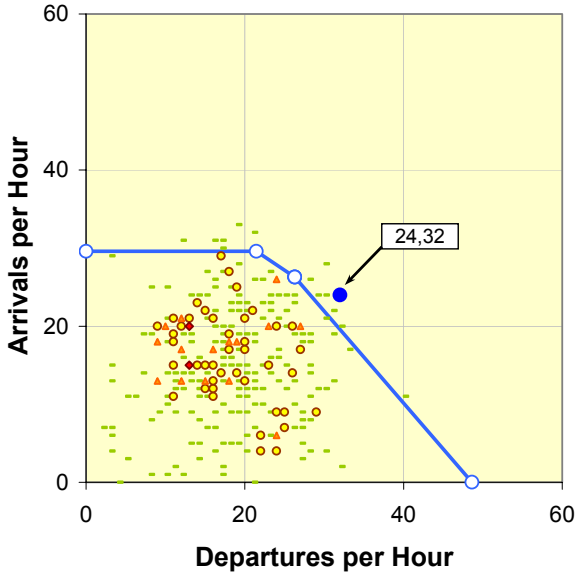
Optimum Rate



Marginal Rate

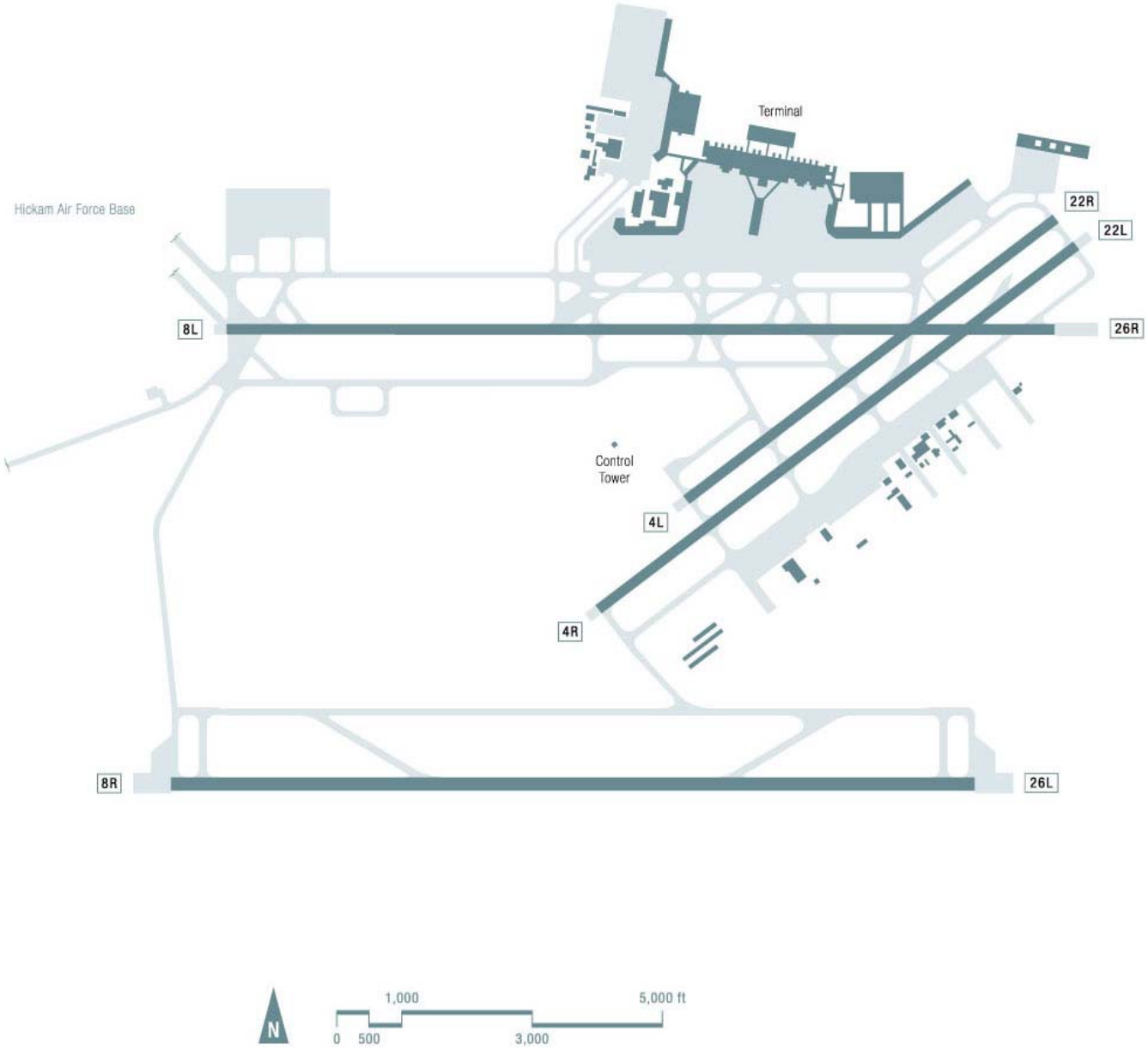


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at FLL.

HONOLULU – Honolulu International (HNL)



Benchmark Results

- The capacity benchmark for Honolulu International Airport today is 110-120 flights per hour (arrivals and departures) in Optimum weather. No data on the occurrence of these conditions was available from the source that provided weather data for other airports.
- The benchmark rate decreases to 60-85 flights per hour in Marginal conditions and to 58-60 flights per hour in IFR conditions.
- These benchmark rates represent balanced operations, with equal numbers of arrivals and departures per hour. Greater total throughput may be possible during arrival or departure peaks.
- There are no planned improvements that will increase Honolulu's capacity under Optimum conditions. However, with the use of CEFR in Marginal conditions, Honolulu's benchmark rate would increase by as much as 22 percent. CEFR is expected to allow visual separations for suitably equipped aircraft in Marginal conditions.
- For the future IFR scenario, it was assumed that the crossing runway procedures will permit "land and hold short" type operations, with arrivals to Runway 8L holding short or exiting before Runway 4R. Such operations occur today in good weather.
- Departures from HNL are generally limited to turns away from land, for noise abatement. This limits departure capacity, but it was assumed that this restriction will continue in the future.
- The following charts compare actual hourly traffic with the calculated capacity curves for HNL.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

HONOLULU – Honolulu International Airport (HNL)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 4R, 8L Departures on 4R, 8L, 8R *Frequency of Use: Insufficient data; facility reported configuration*	Visual approaches, visual separation	**110-120**
Ceiling and visibility above minima for visual approaches (2500 ft ceiling and 3 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: Insufficient data	**Planned improvements (2013)**	Same		**110**
Marginal Rate	**Today**	Arrivals on Runways 4R, 8L Departures on 4R, 8L, 8R *Frequency of Use: Insufficient data; facility reported configuration*	Instrument approaches, visual separation	**60-85**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: Insufficient data	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**104**
IFR Rate	**Today**	Arrivals on Runways 4R, 8L Departures on 4R, 8L, 8R *Frequency of Use: Insufficient data; facility reported configuration*	Instrument approaches, radar separation	**58-60**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: Insufficient data	**Planned improvements (2013)**	Same		**83**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

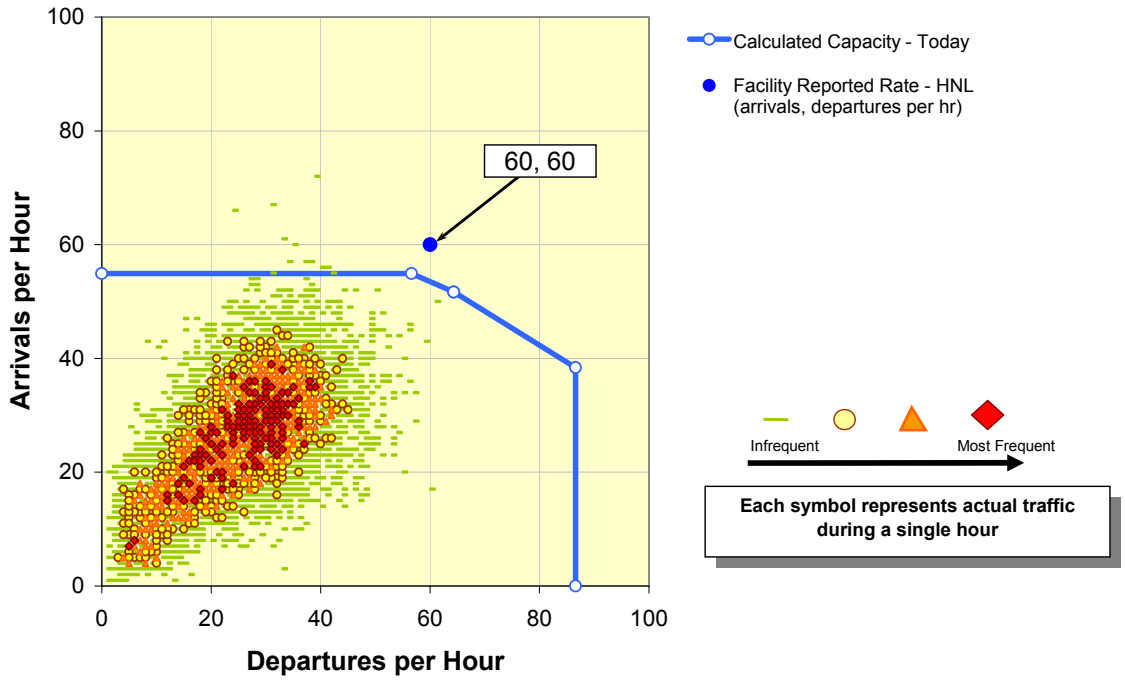
Planned Improvements at HNL include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Improved intersecting runway procedures.

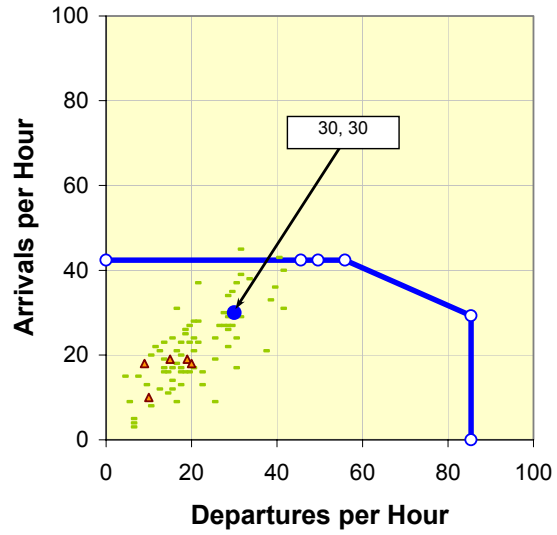
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

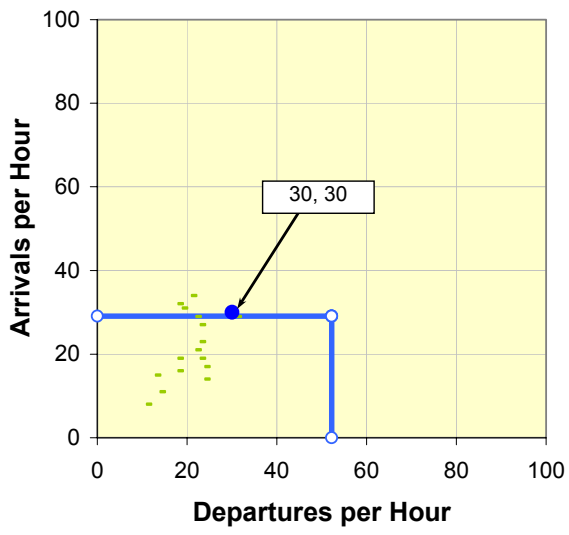
Optimum Rate



Marginal Rate

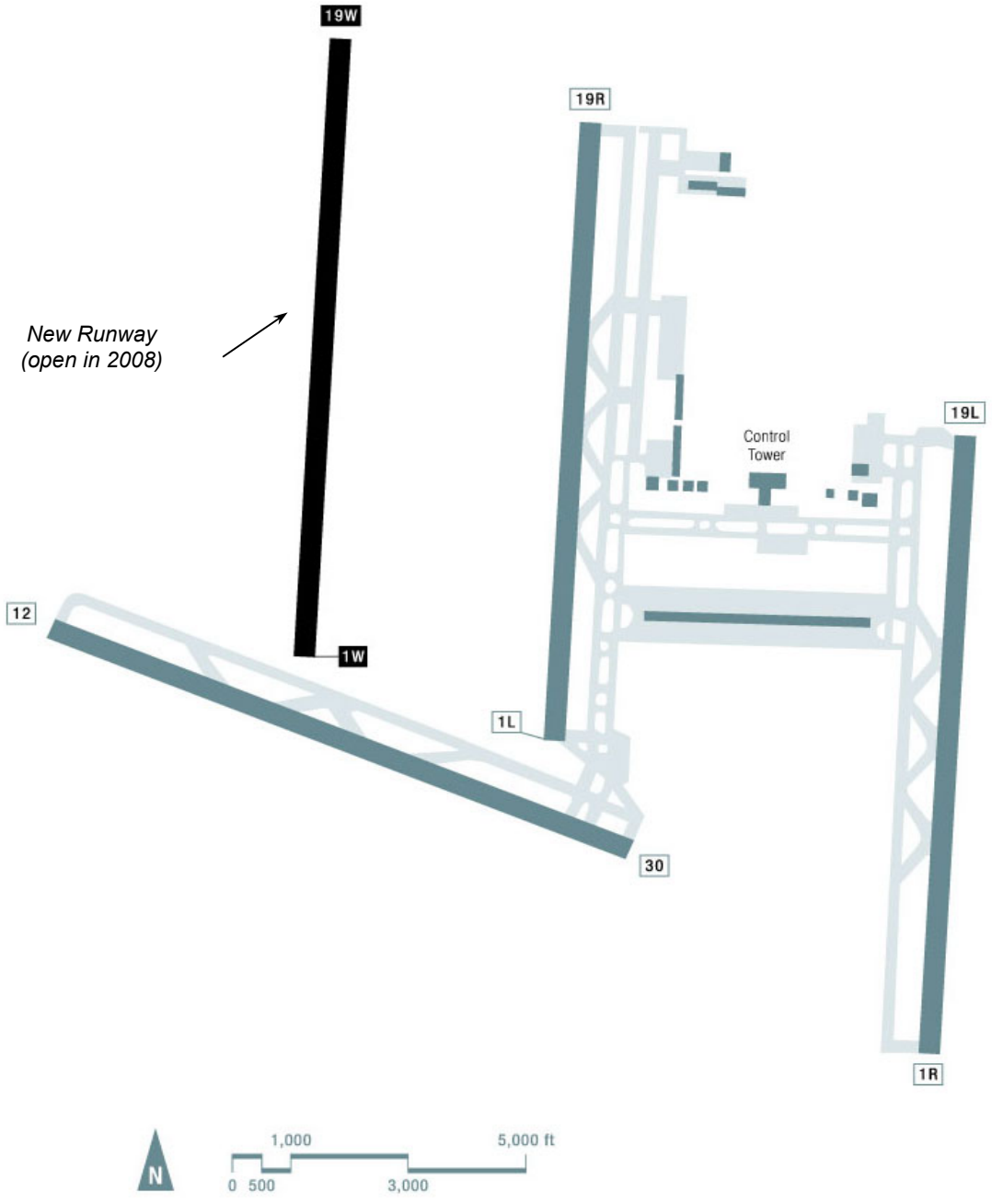


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at HNL.

WASHINGTON – Washington Dulles International (IAD)



Benchmark Results

- The capacity benchmark for Washington Dulles International Airport today is 135 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark rate falls to 114-120 flights per hour in Marginal conditions, and 105-113 flights per hour in IFR conditions.
- A new runway, planned for completion in 2008, is expected to improve the benchmark rates for IAD by as much as 22 to 41 percent, depending on conditions. The projected increase in the benchmark rate can occur only if ground infrastructure, environmental constraints, staffing and equipment requirements allow triple simultaneous approaches. However, triple simultaneous instrument approaches will not be implemented when the runway opens, and it is unlikely that such approaches would be implemented until required by traffic levels. The increase in actual operations may be less if airspace restrictions prevent full use of the new runway.
- Other planned technological improvements at IAD would increase the benchmark rate in Marginal conditions. The benefit in Marginal conditions assumes that all arrivals can use CEFR to achieve visual separations.
- Note that these benchmark rates do not represent balanced operations. IAD rarely operates a balanced configuration. For Optimum and Marginal conditions, the facility reported two rates: an arrival priority rate and a departure priority rate. The Optimum rates are 90 arrivals, 45 departures per hour (90,45) for arrival priority and 45,70 for departure priority. In Marginal conditions, the reported rates are 75,45 and 45,75.
- These rates are based on different runway configurations that favor either arrivals or departures. The benchmark capacity curves combine both preferred configurations for Optimum and Marginal conditions; therefore, frequency data for a single “most common” configuration is not relevant.
- Only a single configuration is used in IFR conditions. The peak arrival configuration in good weather, triple converging approaches, is not available below 1000/3, and so the same configuration can be used for both arrival and departure peaks.
- In the following charts, please note that combining arrival configuration capacity with departure configuration capacity moves the airport’s overall capacity frontier beyond what can be achieved by a single configuration. The result is a higher arrival priority and/or higher departure priority capacity, compared to what can be achieved by a more balanced configuration.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

WASHINGTON – Washington Dulles International Airport (IAD)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today***	Arrivals on 12, 19R, 19L (1R, 1L) Departures on 19L (1R, 30) *Frequency of Use: see text*	Visual approaches, visual separation	**135**
Ceiling and visibility above minima for visual approaches (3000 ft ceiling and 7 mi visibility)	**New Runway (2008)**	Arrivals on 19R, 19L, 19W Departures on 19R, 19L, 19W	Same, with triple simultaneous visual approaches	**171**
Occurrence: 80%	**Planned improvements (2013), including new runway**	Same		**174**
Marginal Rate	**Today***	Arrivals on 12, 19R, 19L (1R, 1L) Departures on 19L (1R, 30) *Frequency of Use: see text*	Instrument approaches, visual separation	**114-120**
Below visual approach minima but better than instrument conditions	**New Runway (2008)**	Arrivals on 19R, 19L, 19W Departures on 19R, 19L, 19W	Same, with triple simultaneous instrument approaches	**171**
Occurrence: 11%	**Planned improvements (2013), including new runway**	Same	Triple simultaneous visual approaches, visual separation	**174**
IFR Rate	**Today**	Arrivals on 1R, 1L Departures on 1R, 30 *Frequency of Use: 54% in IFR conditions*	Instrument approaches, radar separation	**105-113**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway (2008)**	Arrivals on 19R, 19L, 19W Departures on 19R, 19L, 19W	Same, with triple simultaneous instrument approaches	**150**
Occurrence: 9%	**Planned improvements (2013), including new runway**	Same		**150**

* Today Scenario includes both arrival and departure push (in parenthesis) configuations.

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

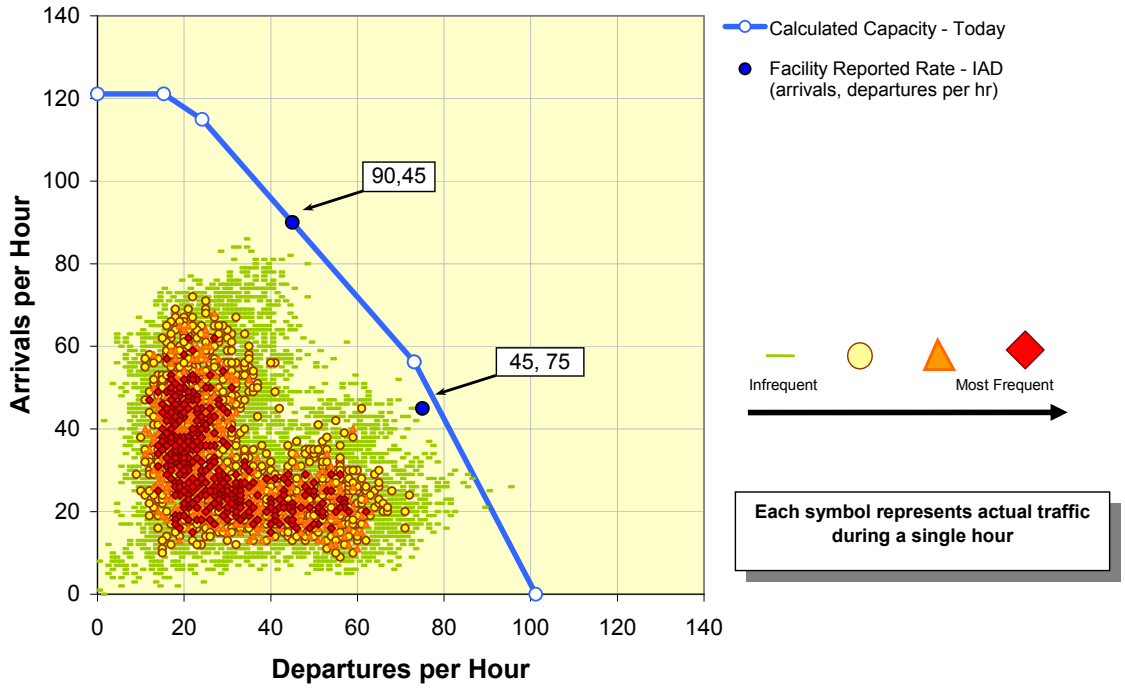
Planned Improvements at IAD include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.

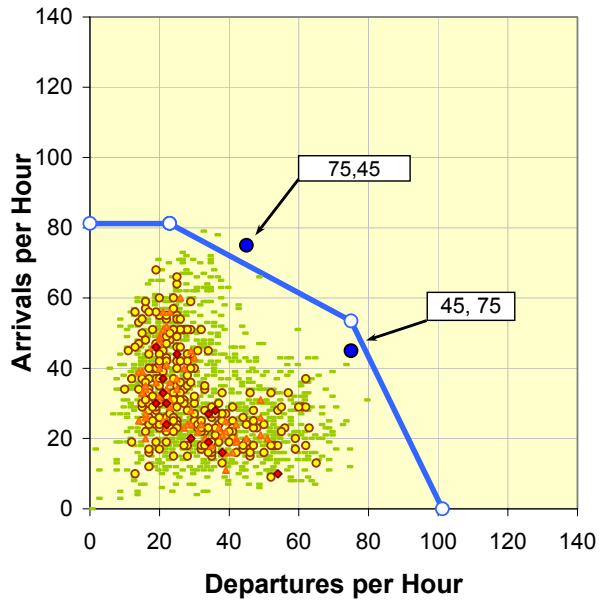
Additional information on this improvement may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

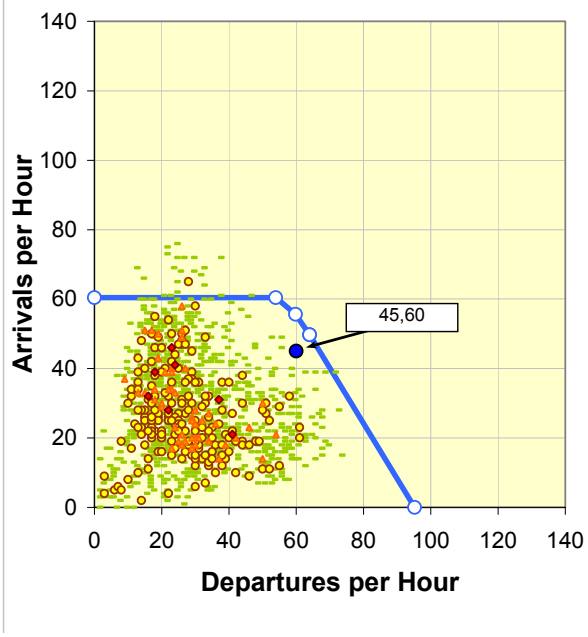
Optimum Rate



Marginal Rate

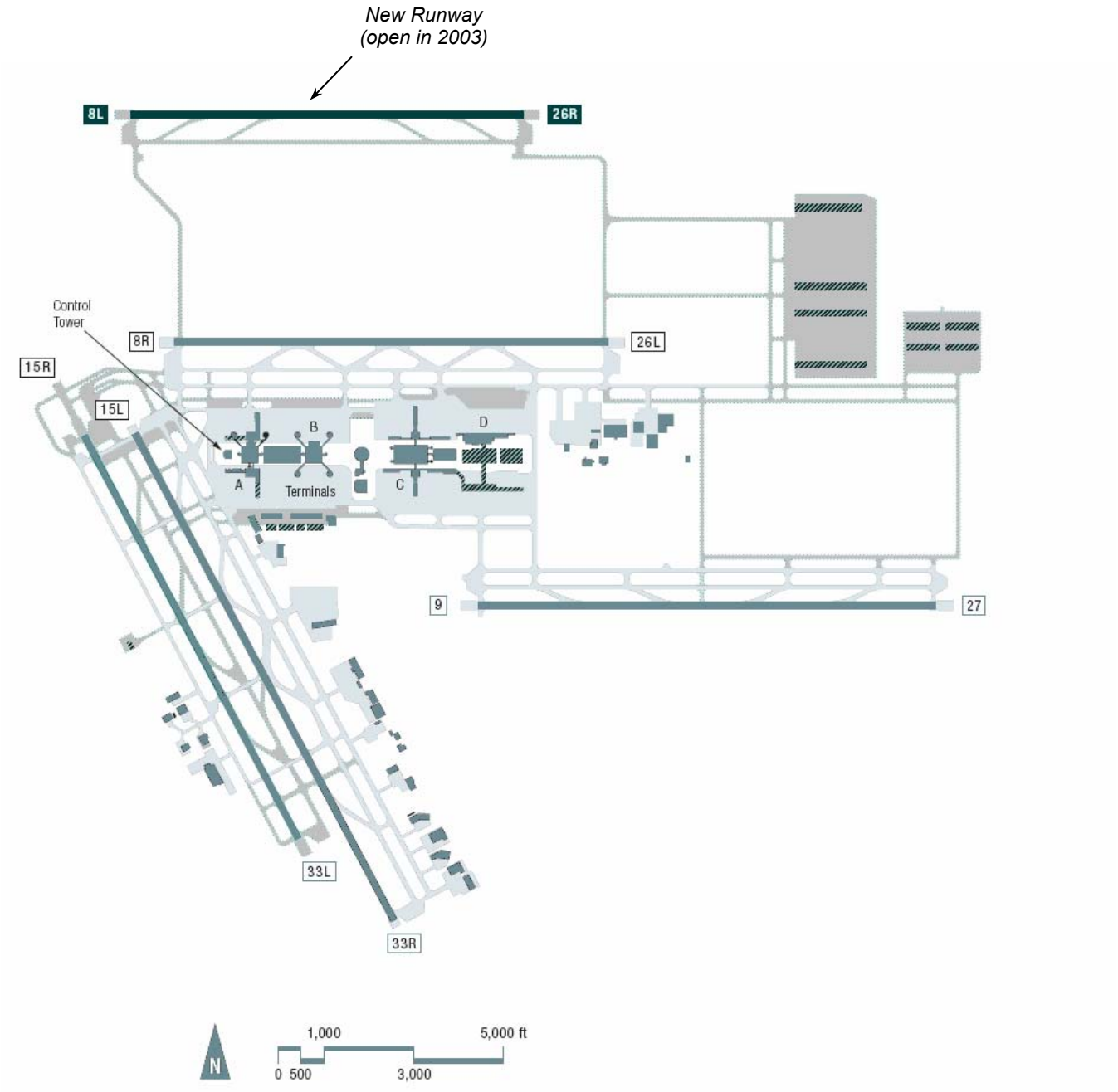


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at IAD.

HOUSTON – Houston George Bush Intercontinental (IAH)



Benchmark Results

- The capacity benchmark for Houston George Bush Intercontinental Airport today is 120-143 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark rate is 120-141 flights per hour in Marginal conditions, and 108-112 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions.
- Note that these benchmarks do not represent balanced operations. Rather, there are more arrivals than departures in the Optimum and Marginal scenarios. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- A new runway, 9L/27R, completed in 2003, will improve capacity benchmarks at IAH by 20-32 percent. This new parallel runway, in conjunction with the existing east-west parallels at IAH, will enable triple simultaneous instrument approaches. The projected increase in the benchmark rate can occur only if ground infrastructure, environmental constraints, staffing and equipment requirements allow triple simultaneous approaches. The increase in actual operations may be less if airspace restrictions prevent full use of the new runway.
- Other planned technological improvements at IAH, such as advanced TMA and RNAV routes, revised wake vortex procedures, and CEFR would increase the benchmark rate substantially in Optimum and Marginal conditions. The benefit in Marginal conditions assumes all arrivals can use CEFR to achieve visual separations. In IFR conditions, advanced TMA is the only improvement that affects capacity, thus accounting for the smaller improvement in this scenario.
- The following charts compare actual hourly traffic with the calculated capacity curves for IAH. Note that some hourly traffic points lie outside the capacity curve, especially in IFR conditions. There are many possible reasons why this may occur without affecting operational safety. For example, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.
- Please note that the extension of Runway 15R/33L was not completed until May 2002. The traffic data in these charts includes the period from January 2000 through June 2002; most of the data was collected before the departure runway was opened. Therefore, the historical data in these charts is not representative of the current capabilities of IAH with all runways available.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

HOUSTON – Houston George Bush Intercontinental Airport (IAH)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on 26, 27 Departures on 15R, 15L, 26 *Frequency of Use: 43% in Optimum conditions*	Visual approaches, visual separation	**120-143**
Ceiling and visibility above minima for visual approaches (4000 ft ceiling and 8 mi visibility)	**New Runway (2003)**	Arrivals on 26R, 26L, 27 Departures on 15R, 15L, 26	Same, with triple simultaneous visual approaches	**193**
Occurrence: 71%	**Planned improvements (2013), including new runway**	Same		**231**
Marginal Rate	**Today**	Arrivals on 26, 27 Departures on 15R, 15L, 26 *Frequency of Use: 47% in Marginal conditions*	Instrument approaches, visual separation	**120-141**
Below visual approach minima but better than instrument conditions	**New Runway (2003)**	Arrivals on 26R, 26L, 27 Departures on 15R, 15L, 26	Same, with triple simultaneous approaches	**193**
Occurrence: 22%	**Planned improvements (2013), including new runway**	Same	Triple smultaneous visual approaches, visual separation	**231**
IFR Rate	**Today**	Arrivals on 26, 27 Departures on 15R, 15L, 26 *Frequency of Use: 46% in IFR conditions*	Instrument approaches, radar separation	**108-112**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway (2003)**	Arrivals on 26R, 26L, 27 Departures on 15R, 15L, 26	Same, with triple simultaneous instrument approaches	**132**
Occurrence: 7%	**Planned improvements (2013), including new runway**	Same		**138**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

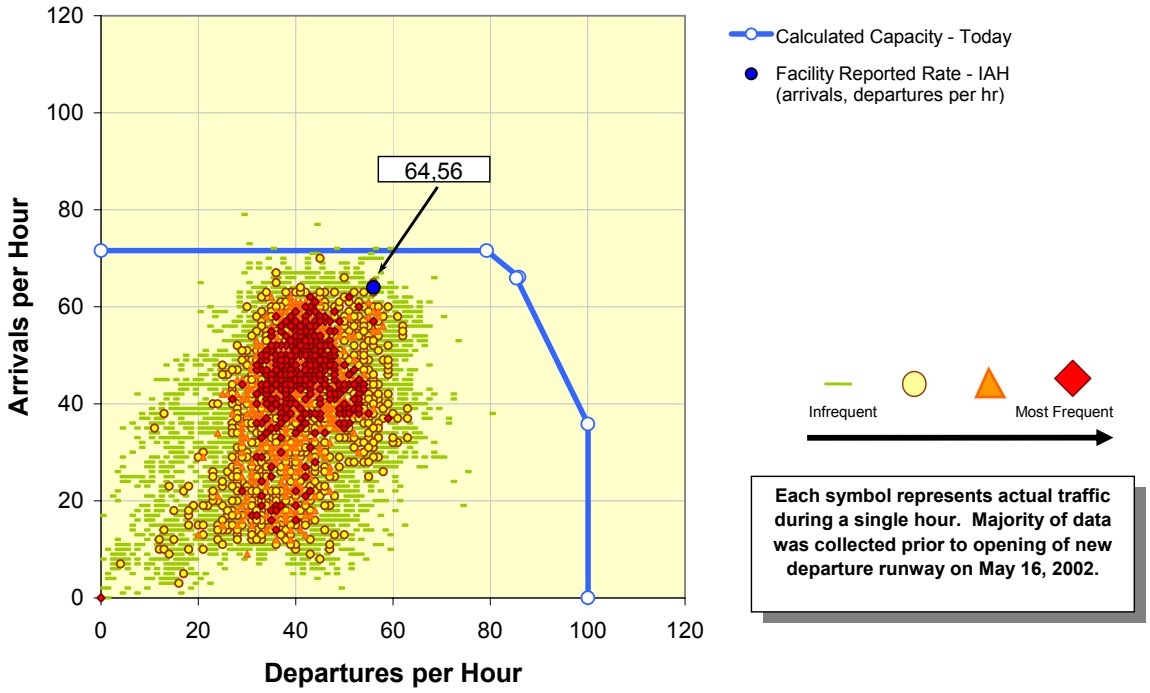
Planned Improvements at IAH include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Revised wake vortex procedures, to increase departure throughput on closely spaced parallel runways in Optimum and Marginal conditions.
- Advanced TMA/RNAV, to improve delivery accuracy and help IAH consistently utilize available capacity in all conditions.

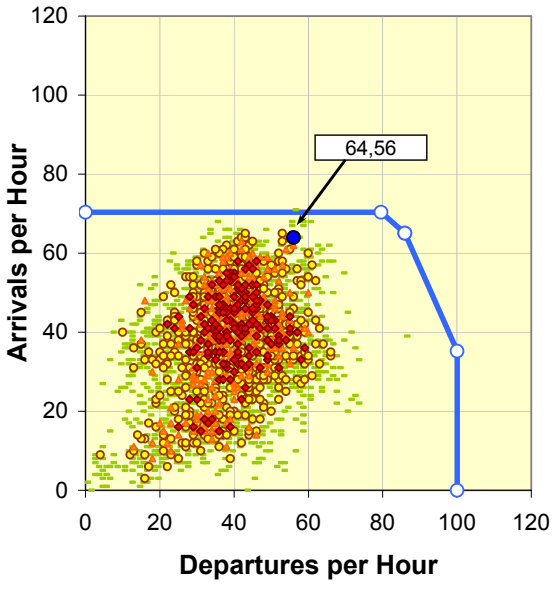
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

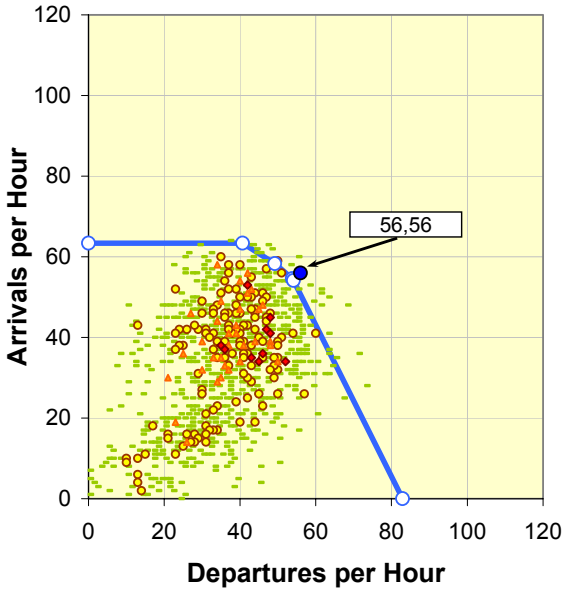
Optimum Rate



Marginal Rate

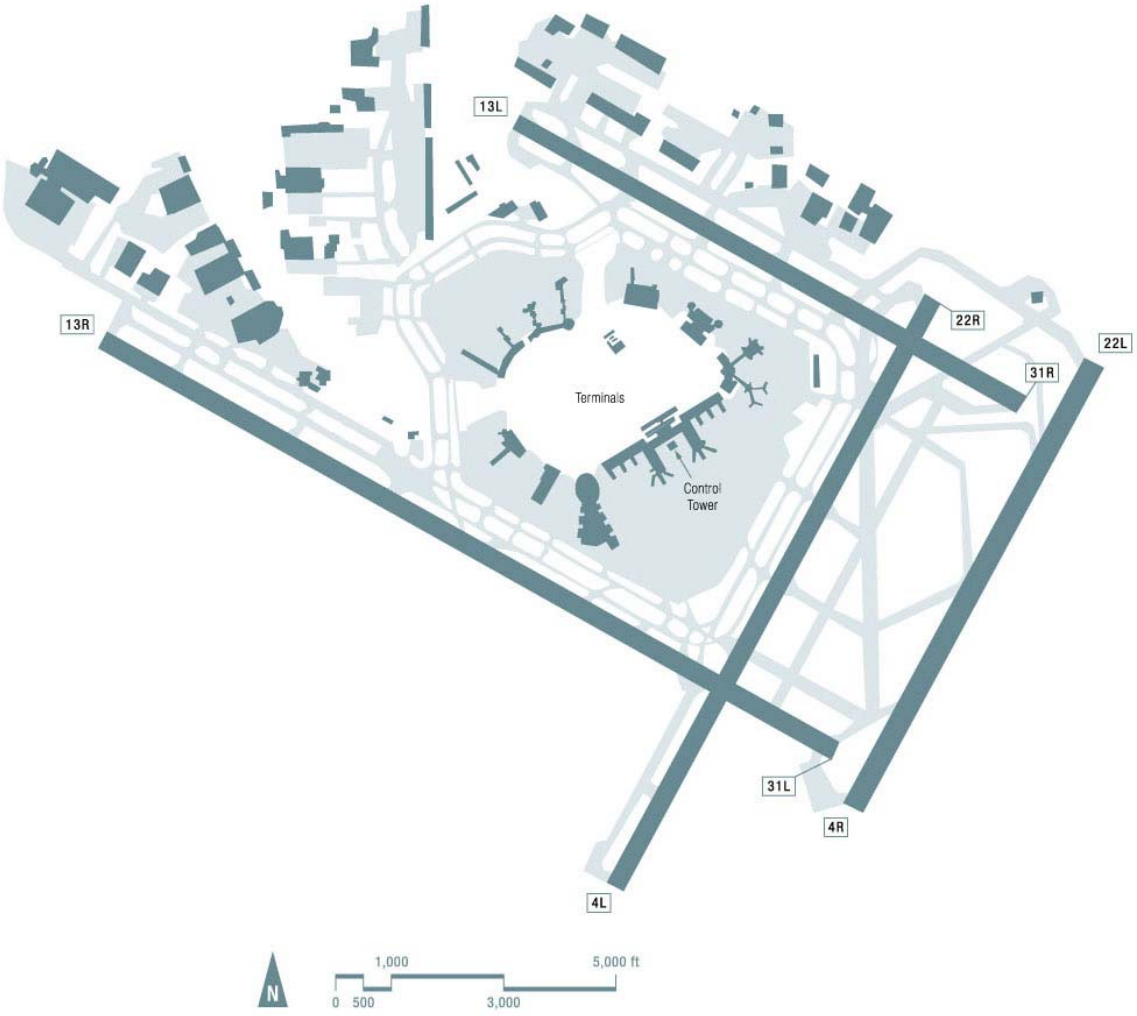


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at IAH.

NEW YORK – New York John F. Kennedy International (JFK)



Benchmark Results

- The capacity benchmark for New York John F. Kennedy International Airport today is 75-87 flights per hour (arrivals and departures) in Optimum weather. The benchmark remains the same in Marginal conditions.
- The benchmark rate decreases slightly to 64-67 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, or when other runway configurations are in use due to wind direction or for noise abatement.
- Note that these benchmarks do not represent balanced operations. Rather, there are more departures than arrivals in each scenario. Greater total throughput may be possible during arrival or departure peaks.
- If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- The most frequently used configuration at JFK in all weather conditions involves operations on Runways 31R and 31L. During periods of arrival demand, both runways are used for arrivals but only Runway 31L is used for departures. Conversely, during periods of departure demand, both runways are used for departures but arrivals mainly use Runway 31R. In IFR conditions, most departures will use Runway 31L.
- JFK consistently uses instrument approaches and radar separation between arrivals, possibly due to the high proportion of international airlines in the traffic mix. Consequently, CEFR (which would allow suitably equipped aircraft to maintain visual separations in Marginal conditions) is not expected to have a significant effect on the benchmark rates at JFK.
- The following charts compare actual hourly traffic with the calculated capacity curves for JFK. A few points lie outside the capacity curves, especially in IFR. There are many possible reasons why this may occur without affecting operational safety. A different runway configuration, with two departure runways, may have been in use rather than the one modeled. Efficient aircraft sequencing or above-average pilot and controller performance can contribute to higher throughputs. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing the use of different ATC procedures.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

NEW YORK – New York John F. Kennedy International Airport (JFK)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 31R (and 31L) Departures on 31L (and 31R) *Frequency of Use: 57% in Optimum conditions*	Instrument approaches, radar separation	**75-87**
Ceiling and visibility above minima for visual approaches (2000 ft ceiling and 4 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 86%	**Planned improvements (2013)**	Same		**87**
Marginal Rate	**Today**	Arrivals on Runways 31R (and 31L) Departures on 31L (and 31R) *Frequency of Use: 33% in Marginal conditions*	Instrument approaches, radar separation	**75-87**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 5%	**Planned improvements (2013)**	Same		**87**
IFR Rate	**Today**	Arrivals on Runways 31R (and 31L) Departures on 31L (and 31R) *Frequency of Use: 28% in IFR conditions*	Instrument approaches, radar separation	**64-67**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 9%	**Planned improvements (2013)**	Same		**67**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

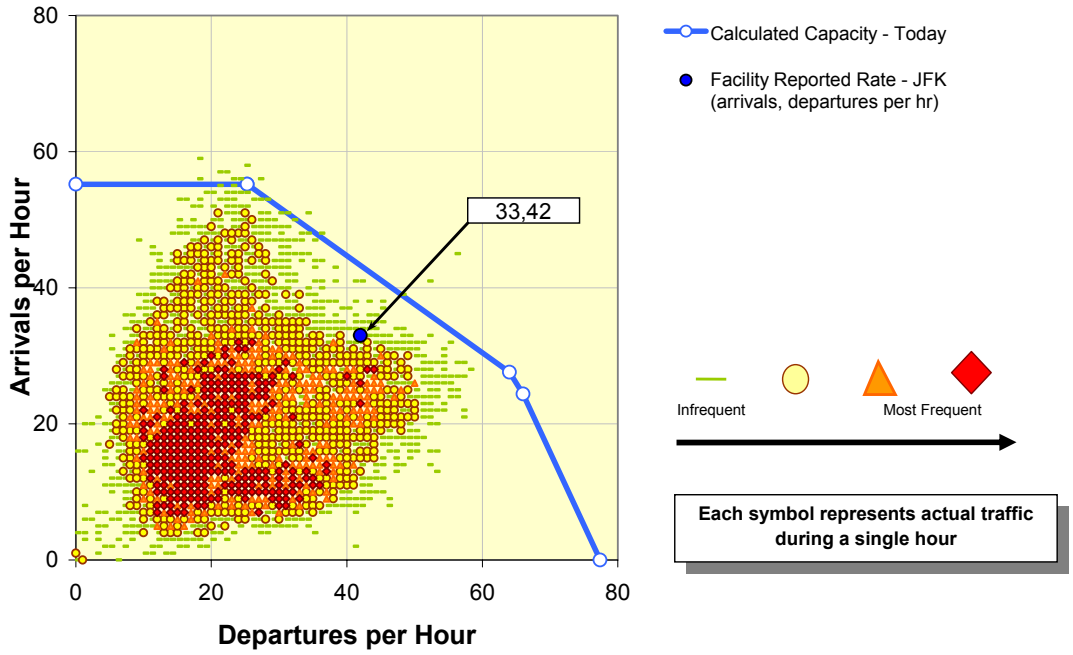
Planned Improvements at JFK are not expected to affect the benchmark rates. These improvements include:

- Airspace redesign and RNAV arrival/departure routes, which would improve operational efficiency but not affect the benchmark configuration.
- PRM, which would allow simultaneous instrument approaches to Runways 22R and 22L (which is not the benchmark configuration).
- CEFR, for reduced in-trail separations between arrivals in Marginal conditions. However, JFK uses instrument approaches and radar separations today even in Optimum conditions, and so is unlikely to take advantage of CEFR capabilities.

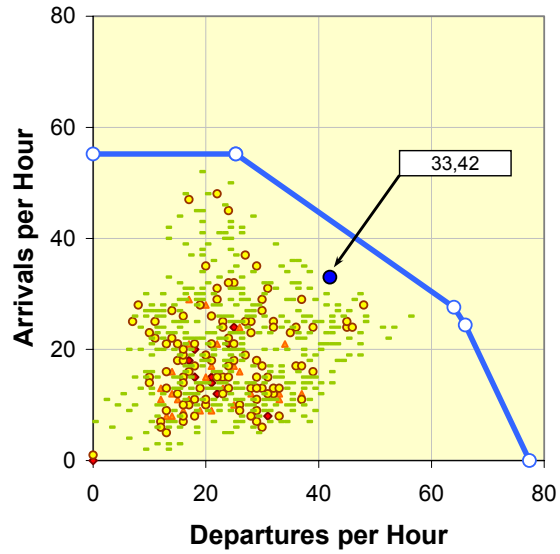
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

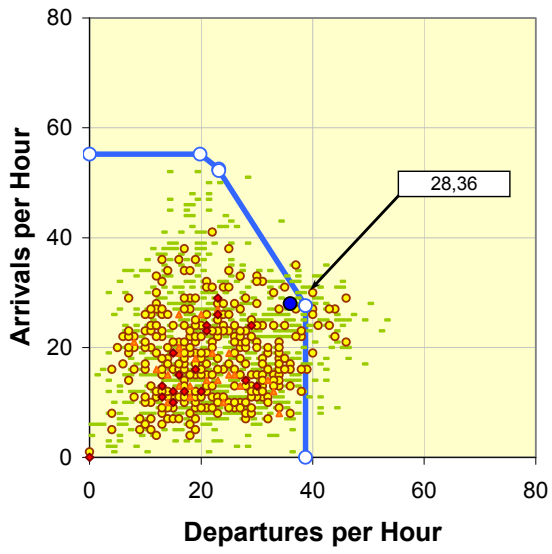
Optimum Rate



Marginal Rate

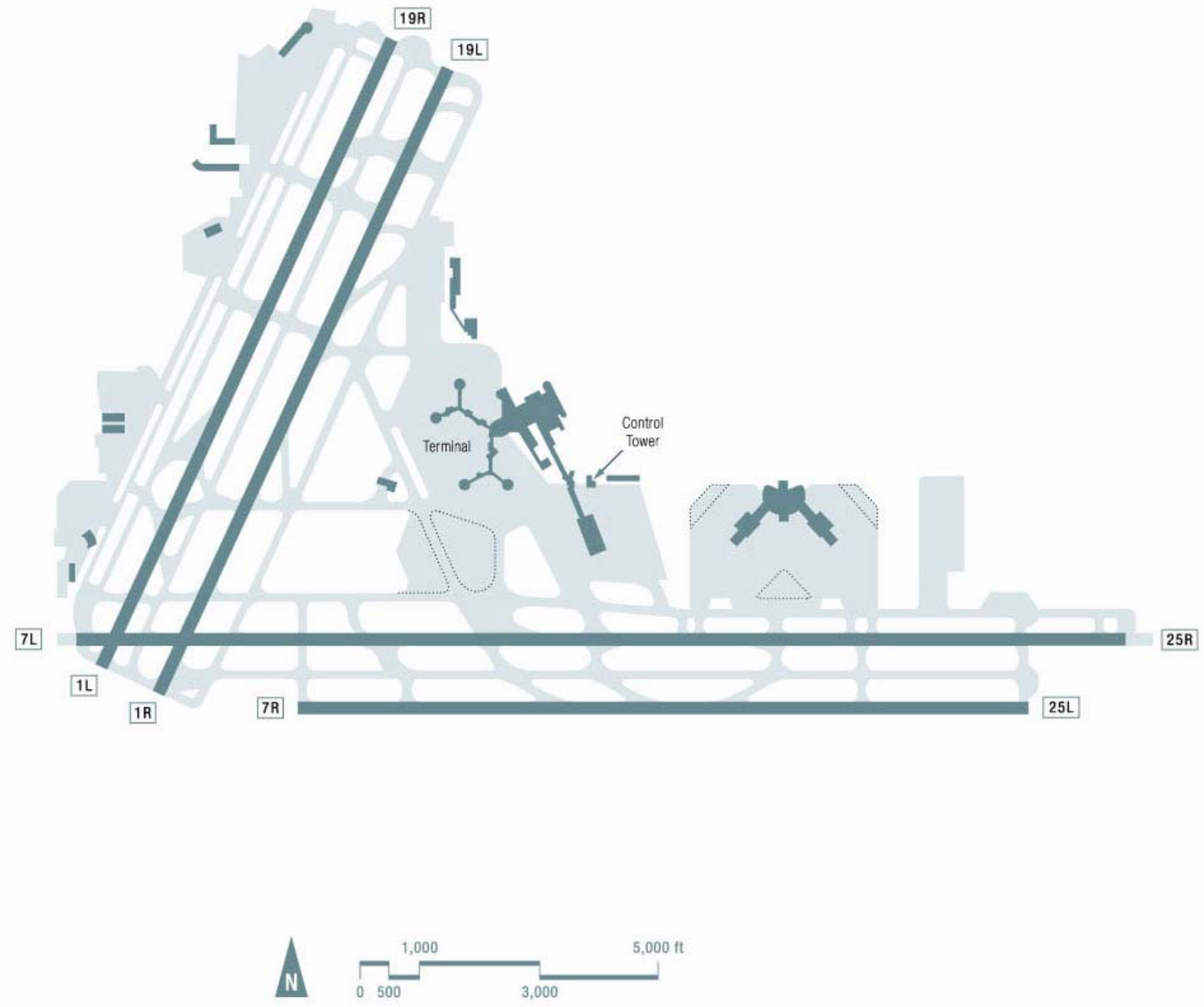


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at JFK.

LAS VEGAS – Las Vegas McCarran International (LAS)



Benchmark Results

- The capacity benchmark for Las Vegas McCarran International Airport today is 102-113 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- Due to the loss of an arrival runway below visual approach minima, the benchmark falls to 77-82 flights per hour in Marginal conditions, and 70 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. However these conditions are rare at LAS. Throughput may be even less when conditions force the use of other configurations.
- Note that these benchmarks do not represent balanced operations. Rather, there are more arrivals than departures in the Optimum scenario, and more departures than arrivals in the Marginal and IFR scenarios. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- Planned technological improvements at LAS would increase the benchmark capacity in Marginal conditions. The benefit in Marginal conditions assumes all arrivals can use CEFR to achieve visual separations. In addition it assumes RNP would give positive guidance on missed approaches to allow lower minima for dual converging arrival streams.
- In the following charts, please note that some of the hourly traffic points fall outside the calculated capacity curves at LAS, especially in Marginal and IFR conditions. There are many possible reasons why this may occur without affecting operational safety. For example, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

LAS VEGAS – Las Vegas McCarran International Airport (LAS)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on 19R, 25L Departures on 19L, 25R *Frequency of Use: insufficient data; facility reported configuration*	Visual approaches, visual separation	**102-113**
Ceiling and visibility above minima for visual approaches (5000 ft ceiling and 5 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 98%	**Planned improvements (2013)**	Same	Visual approaches, visual separation, intersecting runway procedures	**102**
Marginal Rate	**Today**	Arrivals on 25L Departures on 19L, 25R *Frequency of Use: insufficient data; facility reported configuration*	Instrument approaches, visual separation	**77-82**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 2%	**Planned improvements (2013)**	Arrivals on 19R, 25L Departures on 19L, 25R	Visual approaches, visual separation	**99**
IFR Rate	**Today**	Arrivals on 25L Departures on 19L, 25R *Frequency of Use: insufficient data; facility reported configuration*	Instrument approaches, radar separation	**70**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 0%	**Planned improvements (2013)**	Same		**70**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

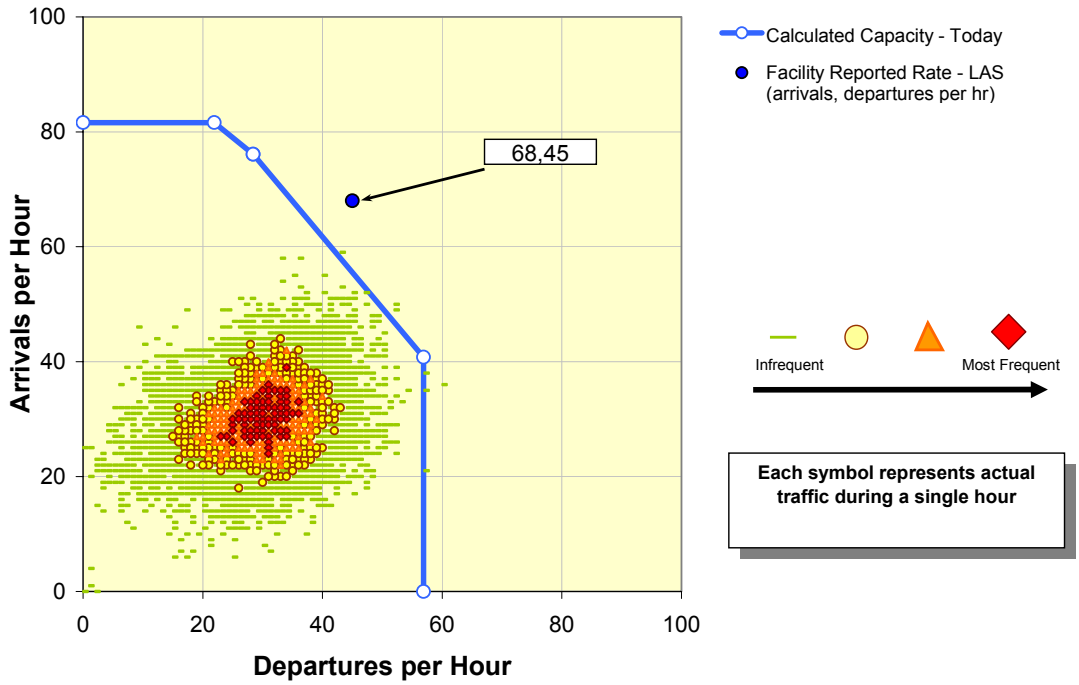
Planned Improvements at LAS include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Intersecting runway procedures in Optimum conditions.
- RNP for positive guidance on missed approach.

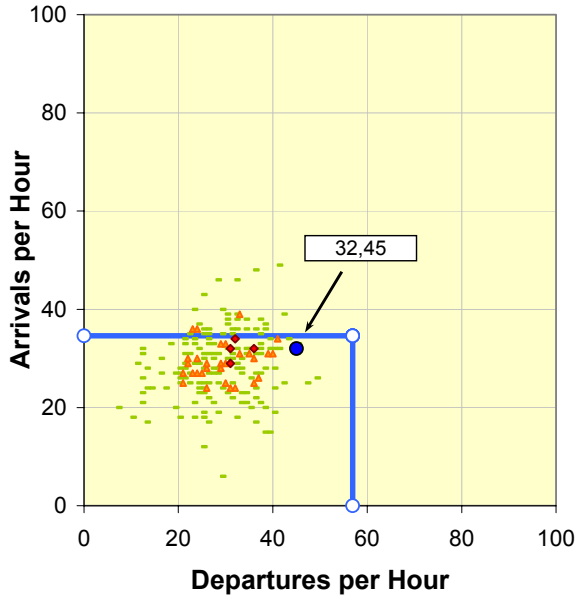
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

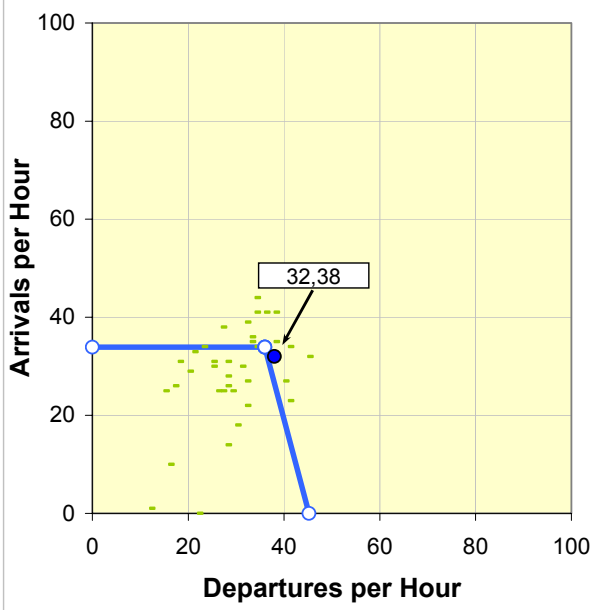
Optimum Rate



Marginal Rate

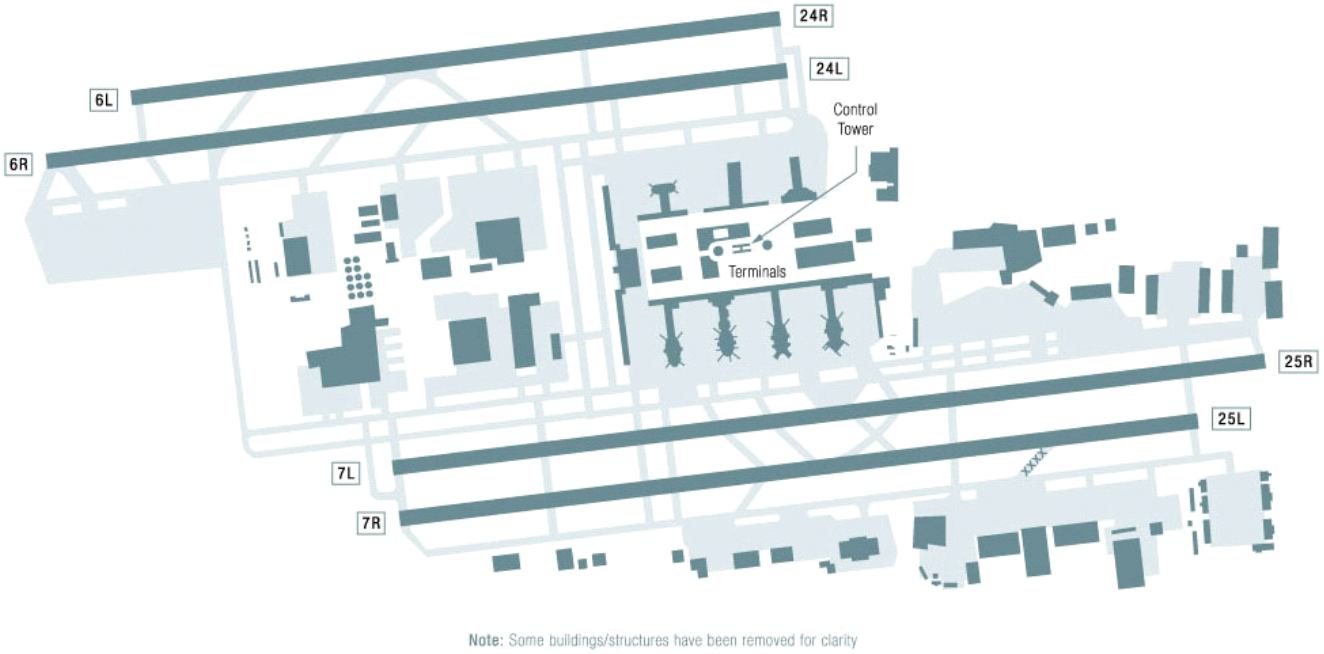


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at LAS.

LOS ANGELES – Los Angeles International (LAX)



Note: Some buildings/structures have been removed for clarity

Benchmark Results

- The capacity benchmark for Los Angeles International Airport today is 137-148 flights per hour (arrivals and departures) in Optimum weather.
- The benchmark rate decreases to 126-132 flights per hour in Marginal conditions, and to 117-124 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, or if other runway configurations are used.
- Note that these benchmark rates do not always represent balanced operations. Rather, there may be more arrivals than departures in all three weather scenarios. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- According to LAX facility reports, the most common configuration used at LAX under all three weather scenarios is arrivals on Runways 24R and 25L with some sidestep arrivals on Runways 24L and 25R in good weather. Departures use the inboard runways, Runways 24L and 25R.
- Planned technological improvements at LAX would increase the benchmark rate slightly in Marginal conditions due to CEFR, which will allow suitably equipped aircraft to maintain visual separations, and advanced TMA and RNAV procedures which are assumed to improve delivery accuracy.
- The following charts compare actual hourly traffic with the calculated capacity curves for LAX. A few points lie outside the capacity curves, especially in IFR. There are many possible reasons why this may occur without affecting operational safety. Higher throughputs may be possible through more efficient sequencing of aircraft, or when pilot and controller performance is better than average. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing the use of different ATC procedures.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

LOS ANGELES – Los Angeles International Airport (LAX)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 24R, 25L Departures on 24L, 25R *Frequency of Use: Insufficient data; facility reported configuration*	Visual approaches, visual separation	**137-148**
Ceiling and visibility above minima for visual approaches (2500 ft ceiling and 3 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: Insufficient data	**Planned improvements (2013)**	Same		**173**
Marginal Rate	**Today**	Arrivals on Runways 24R, 25L Departures on 24L, 25R *Frequency of Use: Insufficient data; facility reported configuration*	Instrument approaches, visual separation	**126-132**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: Insufficient data	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**173**
IFR Rate	**Today**	Arrivals on Runways 24R, 25L Departures on 24L, 25R *Frequency of Use: Insufficient data; facility reported configuration*	Instrument approaches, radar separation	**117-124**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: Insufficient data	**Planned improvements (2013)**	Same		**128**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

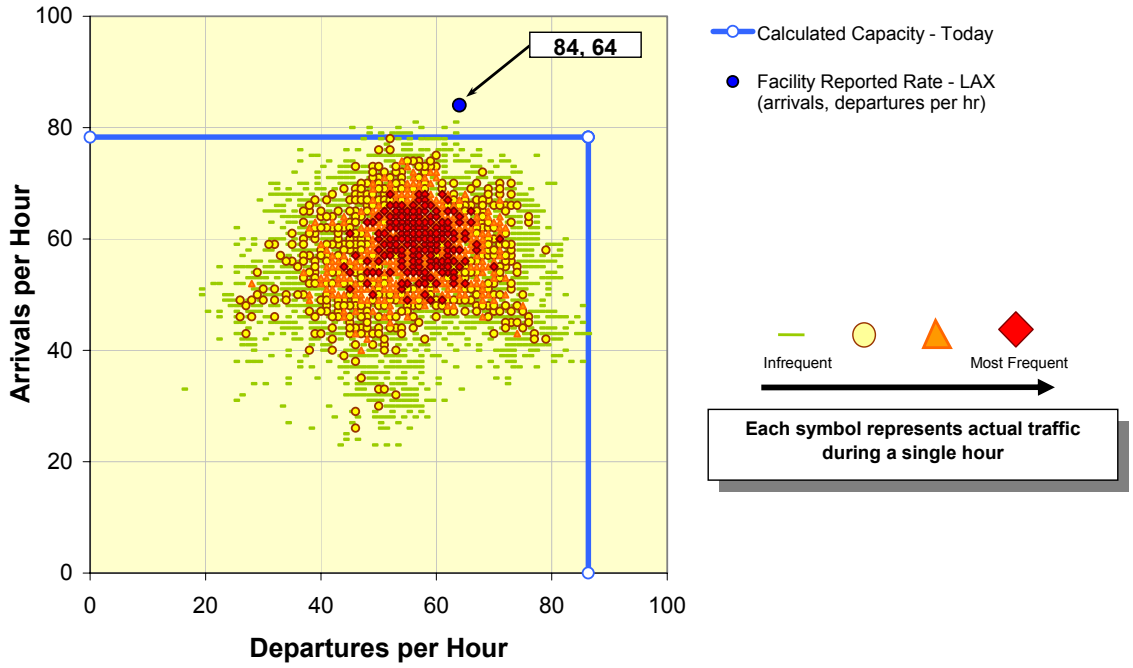
Planned Improvements at LAX include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Advanced TMA/RNAV to improve delivery accuracy and help LAX consistently utilize their available capacity.

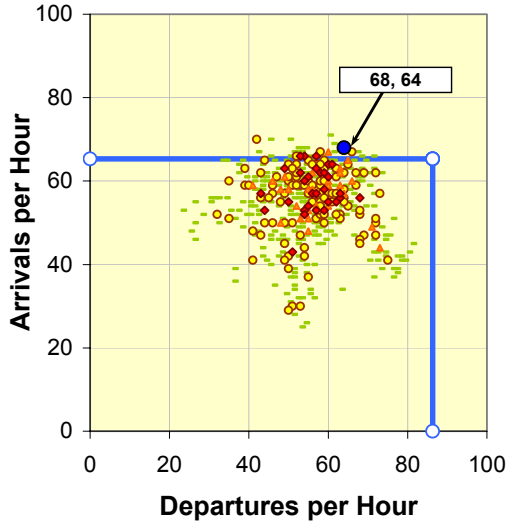
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

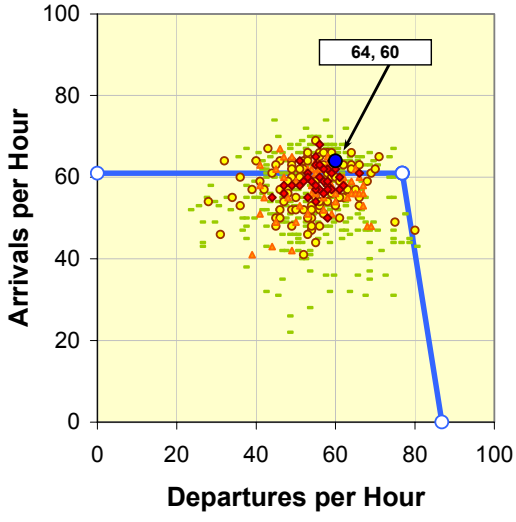
Optimum Rate



Marginal Rate

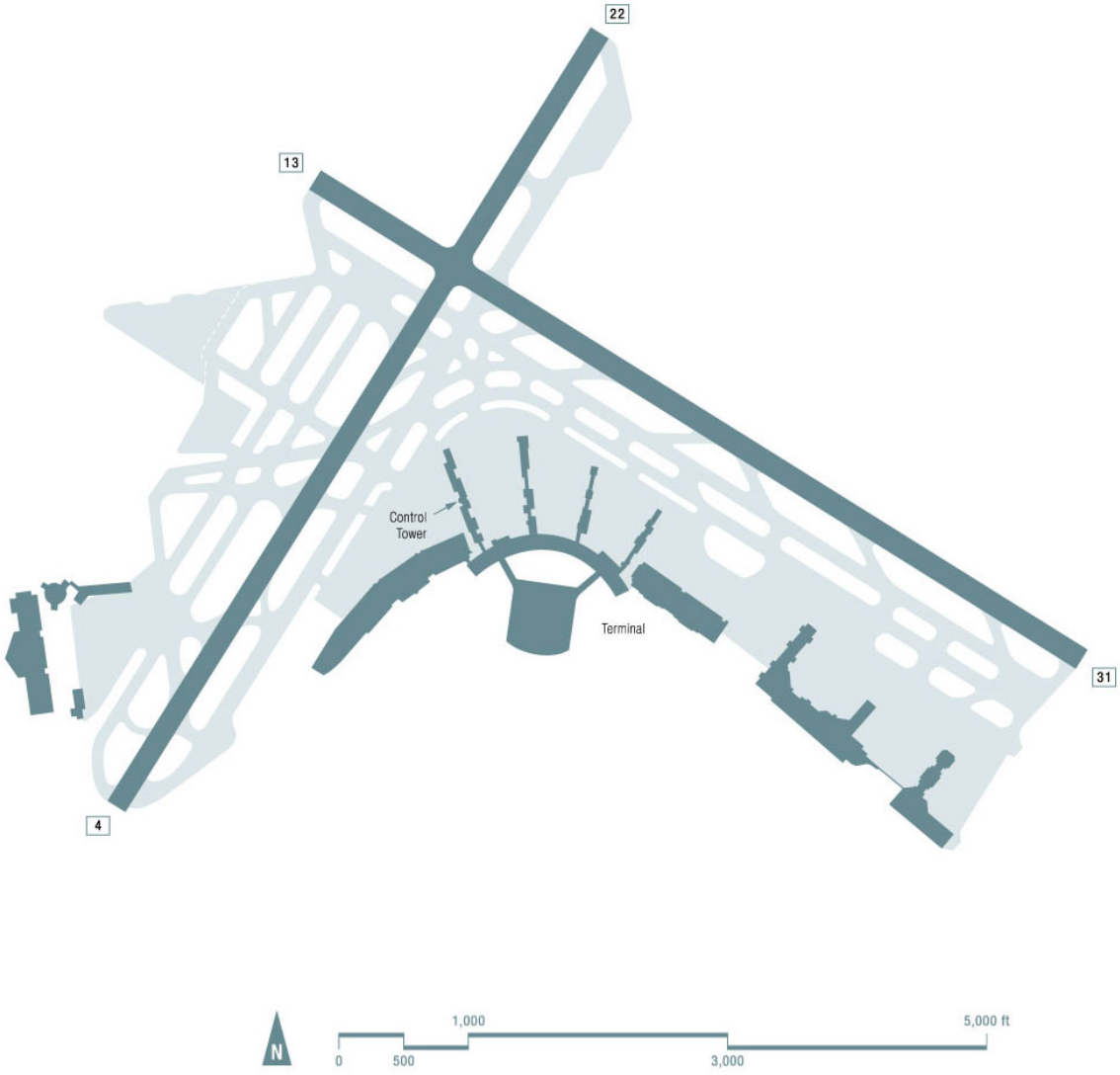


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at LAX.

NEW YORK – New York La Guardia (LGA)



Benchmark Results

- The capacity benchmark for New York La Guardia Airport today is 78-85 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark rate is 74-84 flights per hour in Marginal conditions, and 69-74 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Throughput may be less when conditions force the use of other configurations.
- These benchmark rates represent balanced operations, with equal numbers of arrivals and departures per hour. Greater total throughput may be possible during arrival or departure peaks.
- Planned technological improvements at LGA would increase the benchmark rate slightly in Marginal conditions. The benefit in Marginal conditions assumes that CEFR enables visual separations and the use of the same runway configuration as in Optimum conditions.
- In the following charts, please note that a number of hourly traffic points fall outside the calculated capacity curves at LGA, especially in IFR conditions. There are many possible reasons why this may occur without affecting operational safety, including efficient sequencing of aircraft and above-average controller and pilot performance. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

NEW YORK – New York La Guardia Airport (LGA)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on 22 Departures on 13 *Frequency of Use: 25% in Optimum conditions*	Visual approaches, visual separation	**78-85**
Ceiling and visibility above minima for visual approaches (3200 ft ceiling and 4 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 81%	**Planned improvements (2013)**	Same		**85**
Marginal Rate	**Today**	Arrivals on 4 Departures on 13 *Frequency of Use: 37% in Marginal conditions*	Instrument approaches, visual separation	**74-84**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 10%	**Planned improvements (2013)**	Arrivals on 22 Departures on 13	Visual approaches, visual separation	**85**
IFR Rate	**Today**	Arrivals on 4 Departures on 13 *Frequency of Use: 48% in IFR conditions*	Instrument approaches, radar separation	**69-74**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 9%	**Planned improvements (2013)**	Same		**69**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

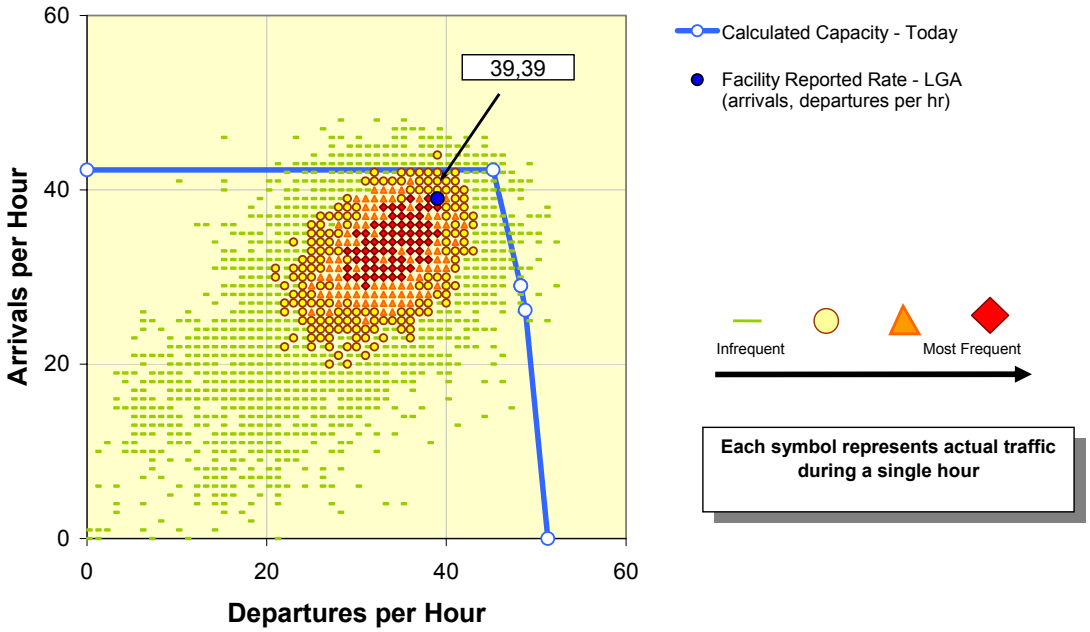
Planned Improvements at LGA include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions

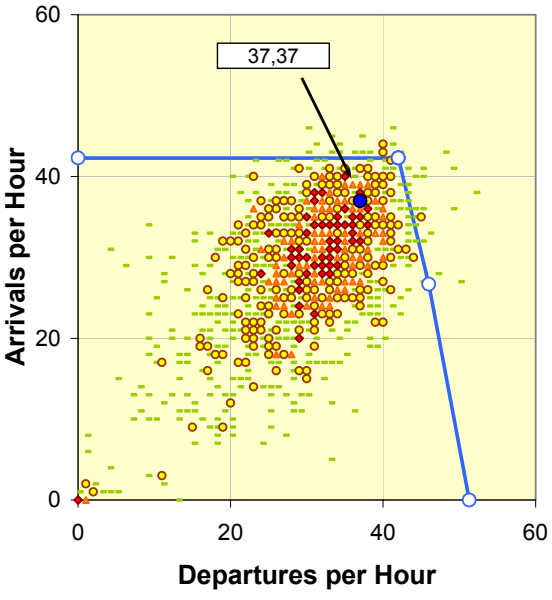
Additional information on this improvement may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

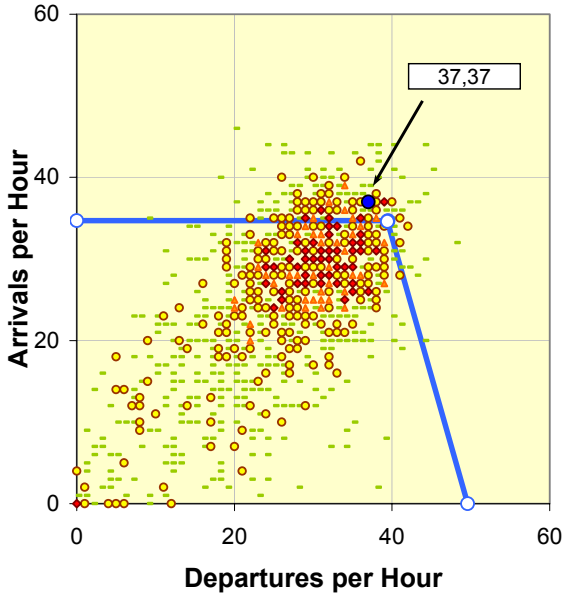
Optimum Rate



Marginal Rate

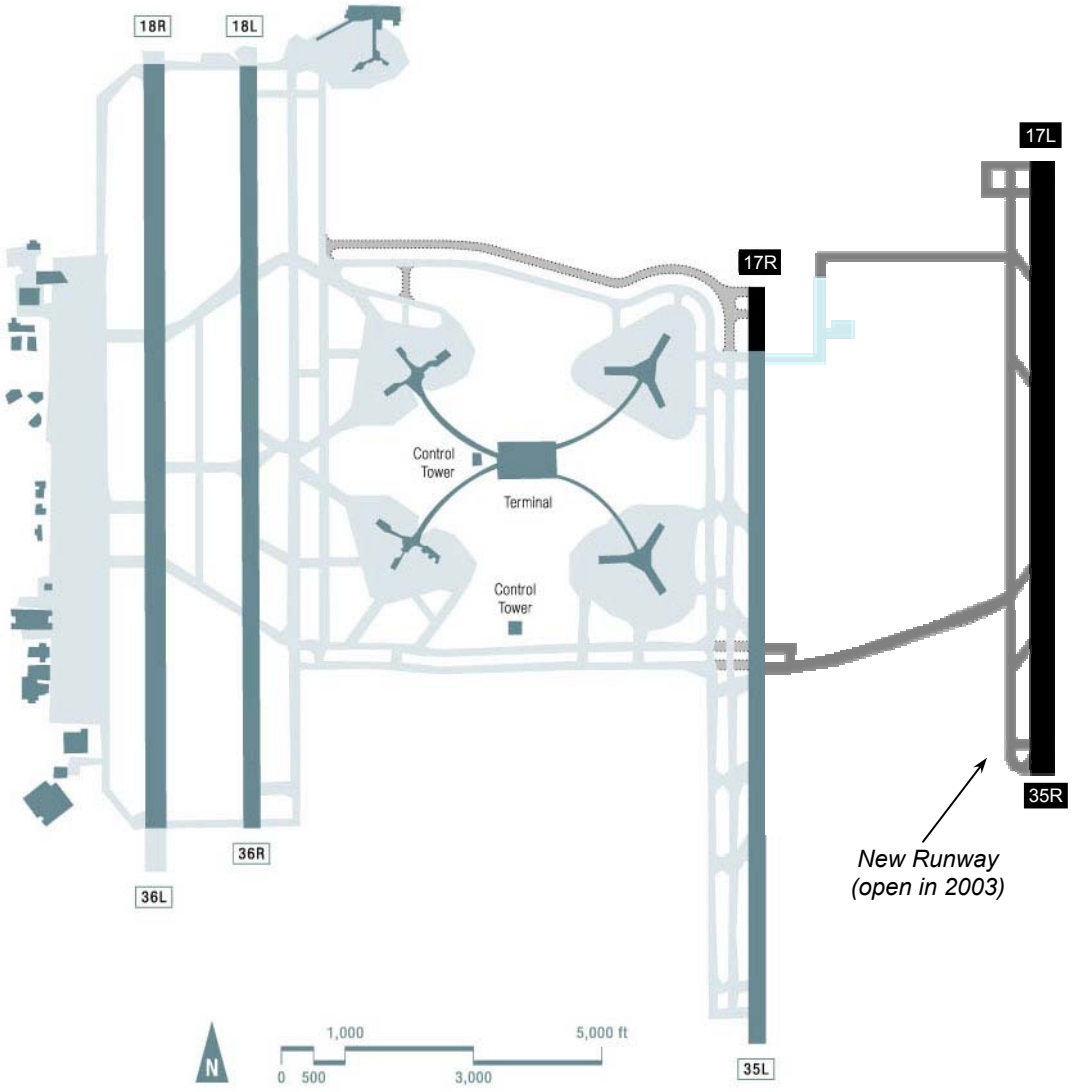


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at LGA.

ORLANDO – Orlando International (MCO)



Benchmark Results

- The capacity benchmark for Orlando International Airport today is 144-164 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark rate decreases slightly to 132-144 flights per hour in Marginal conditions, and to 104-117 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, or if thunderstorms affect operations.
- These benchmarks represent balanced operations, with equal numbers of arrivals and departures per hour. Greater total throughput may be possible during arrival or departure peaks.
- A new runway opened at MCO in 2003. This runway will potentially allow triple simultaneous approaches, which would increase the benchmark capacity by 30-45 percent. However, triple simultaneous instrument approaches have not been implemented yet at MCO, and it is unlikely that such approaches would be implemented until required by traffic levels. The projected increase in the benchmark can occur *only* if ground infrastructure, environmental constraints, staffing and equipment requirements allow triple approaches at MCO. The increase in actual operations may be less if airspace restrictions prevent full use of the new runway.
- Other planned technological improvements at MCO would increase the benchmark rate by an additional 6-7 percentage points. This additional benefit derives from CEFR, which will allow visual separations by suitably equipped aircraft in Marginal conditions, and from advanced wake vortex procedures for operations on Runways 18R and 18L. These improvements will also help to increase throughput during arrival and departure peaks.
- The following charts compare actual hourly traffic with the calculated capacity curves for MCO.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

ORLANDO – Orlando International Airport (MCO)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 18R, 18L, 17R Departures on 18R, 18L, 17R *Frequency of Use: 63% in Optimum conditions*	Visual approaches, visual separation	**144-164**
Ceiling and visibility above minima for visual approaches (2500 ft ceiling and 3 mi visibility)	**New Runway (2003)**	Arrivals on Runways 18R, 18L, 17R, 17L Departures on 18R, 18L, 17R, 17L		**221**
Occurrence: 91%	**Planned improvements (2013), including new runway**	Same		**221**
Marginal Rate	**Today**	Arrivals on Runways 18R, 17R Departures on 18L, 17R *Frequency of Use: 60% in Marginal conditions*	Instrument approaches, visual separation	**132-144**
Below visual approach minima but better than instrument conditions	**New Runway (2003)**	Arrivals on Runways 18R, 17R, 17L Departures on 18L, 17R, 17L		**193**
Occurrence: 4%	**Planned improvements (2013), including new runway**	Same	Visual approaches, visual separation	**204**
IFR Rate	**Today**	Arrivals on Runways 18R, 17R Departures on 18L, 17R *Frequency of Use: 65% in IFR conditions*	Instrument approaches, radar separation	**104-117**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway (2003)**	Arrivals on Runways 18R, 17R, 17L Departures on 18L, 17R, 17L		**167**
Occurrence: 5%	**Planned improvements (2013), including new runway**	Same		**174**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

Full operational use of the new parallel runway will require digital controller displays (but not PRM) to enable triple simultaneous instrument approaches, and an airspace redesign to deliver aircraft efficiently to the approaches.

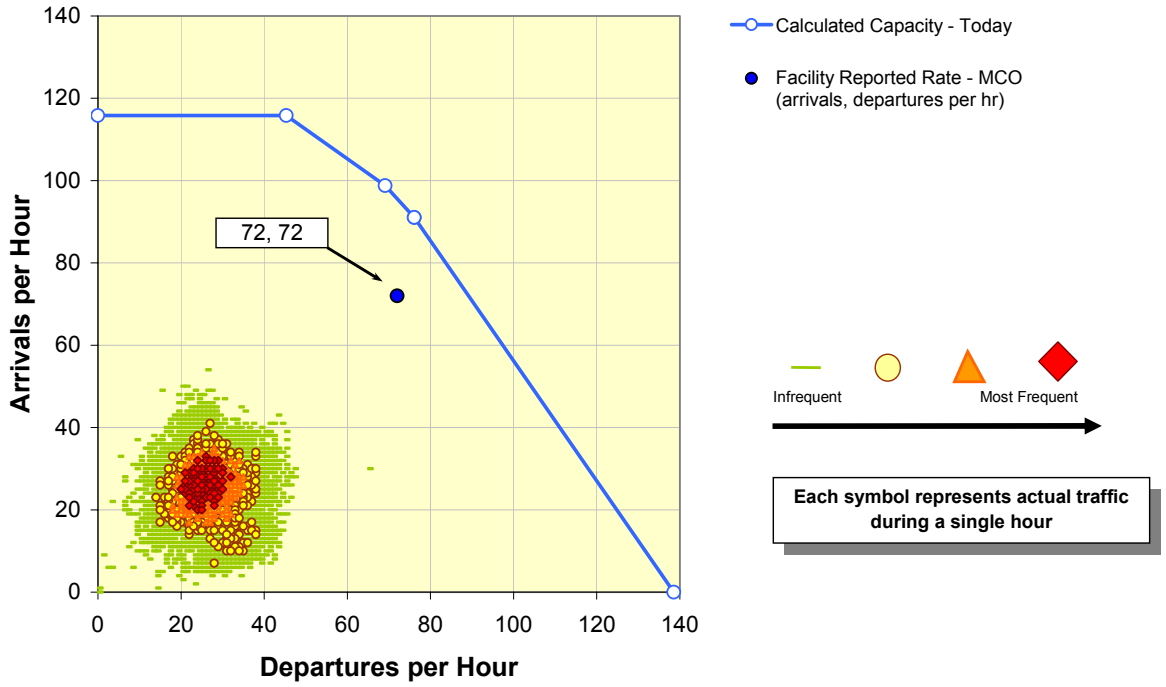
Other Planned Improvements at MCO include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Improved wake vortex procedures, for reduced separation between consecutive arrivals or consecutive departures to the close parallel runways 18R/36L and 18L/36R.

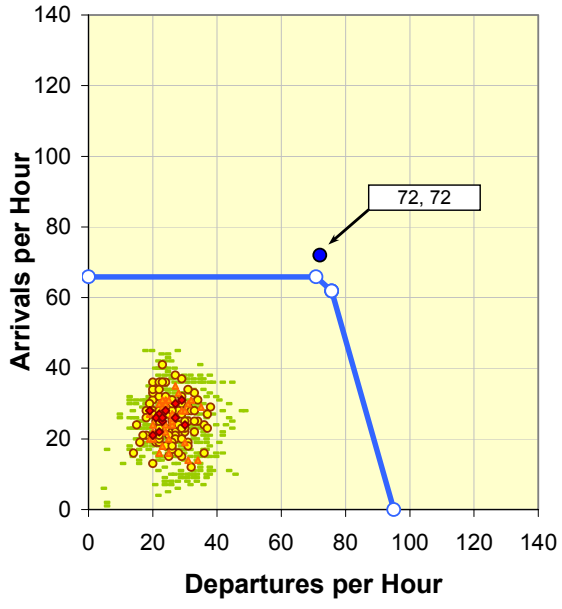
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

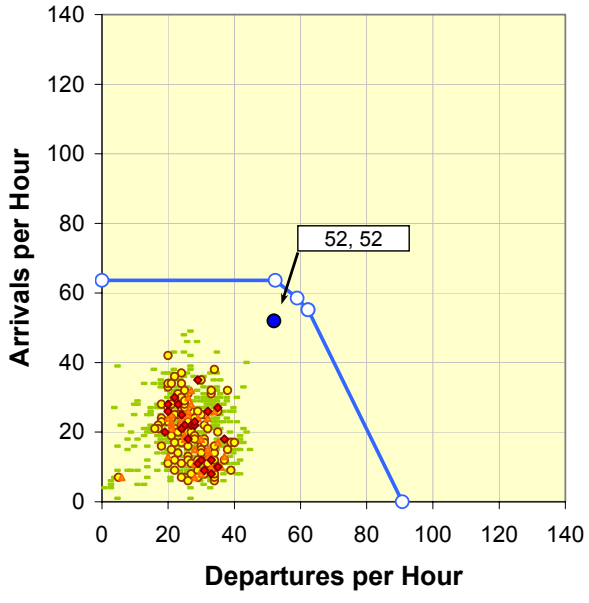
Optimum Rate



Marginal Rate

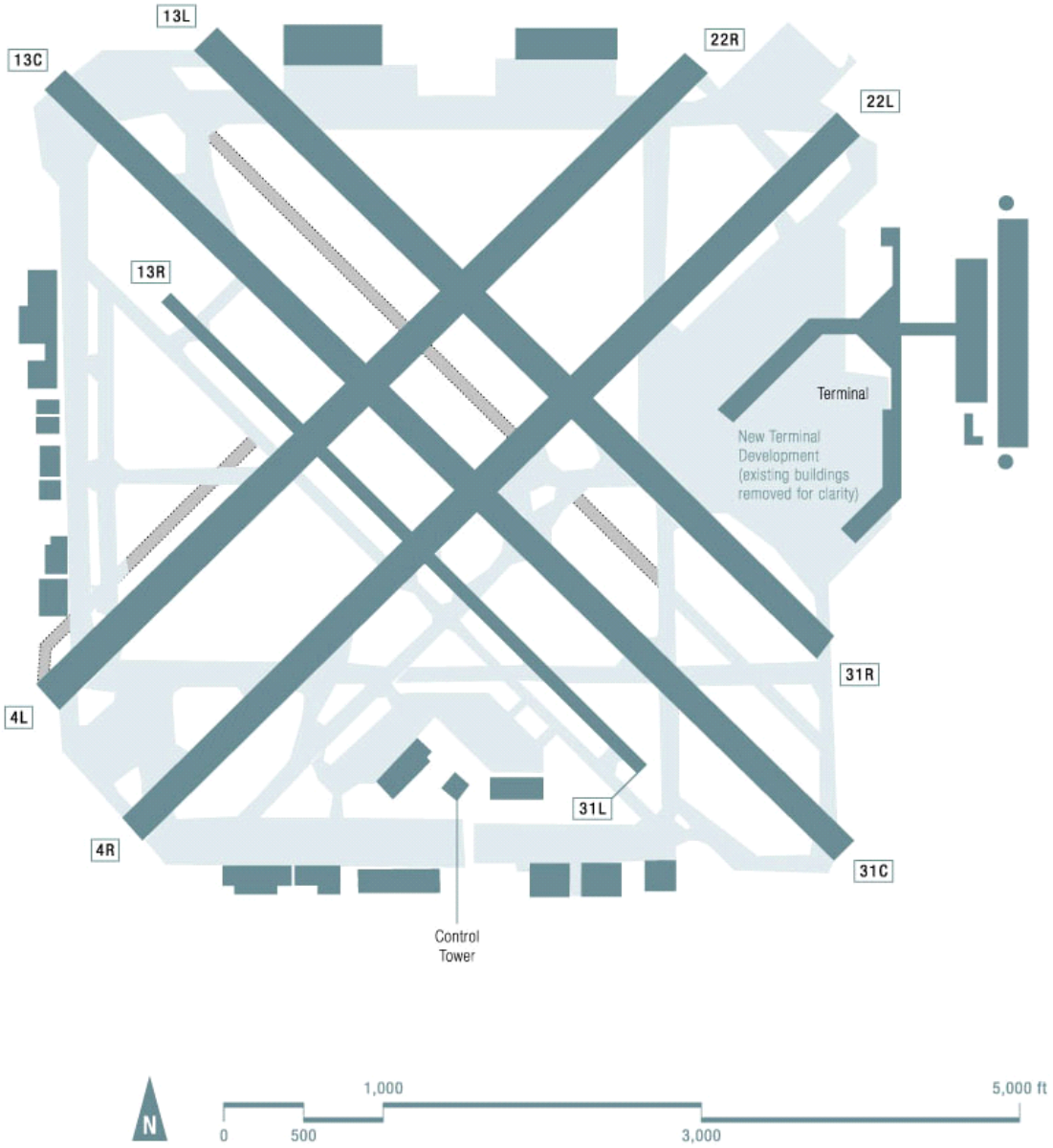


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at MCO.

CHICAGO – Chicago Midway International (MDW)



Benchmark Results

- The capacity benchmark for Chicago Midway International Airport today is 64-65 flights per hour (arrivals and departures) in Optimum weather. The benchmark rate remains the same in Marginal conditions.
- The benchmark rate decreases to 61-64 flights per hour in IFR conditions.
- According to ATC facility reports, the most common configuration used at MDW under Optimum and Marginal scenarios is arrivals on Runway 31C with some landings of "Small" category aircraft on Runways 31R and 31L.
- Planned technological and procedural improvements at MDW would increase the benchmark capacity in Optimum and Marginal conditions. A redesign of the Chicago airspace was assumed to allow use of visual separations between arrivals. The use of CEFR in Marginal conditions would allow visual separations by suitably equipped aircraft. The increase during peak arrival periods would be greater than the increase in the benchmark rate.
- These improvements would not increase the benchmark rate under IFR conditions.
- The following charts compare actual hourly traffic with the calculated capacity curves for MDW. A few points lie outside the capacity curves. There are many possible reasons why this may occur without affecting operational safety. Higher throughputs may be possible through more efficient sequencing of aircraft, or when pilot and controller performance is better than average. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing the use of different ATC procedures.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

CHICAGO – Chicago Midway International Airport (MDW)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate Ceiling and visibility above minima for visual approaches (1900 ft ceiling and 3 mi visibility) *Occurrence: 84%*	**Today**	Arrivals on Runways 31C, landings of "small" category aircraft on 31R/L, Departures on 31C and 22L *Frequency of Use: 54% in optimum conditions*	Instrument approaches, visual separation	**64-65**
	New Runway	N/A		**N/A**
	Planned improvements (2013)	Same	Visual approaches, visual separation	**71**
Marginal Rate Below visual approach minima but better than instrument conditions *Occurrence: 7%*	**Today**	Arrivals on Runways 31C, landings of "small" category aircraft on 31R/L, Departures on 31C and 22L *Frequency of Use: 57% in optimum conditions*	Instrument approaches, visual separation	**64-65**
	New Runway	N/A		**N/A**
	Planned improvements (2013)	Same	Visual approaches, visual separation	**71**
IFR Rate Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles) *Occurrence: 8%*	**Today**	Arrivals on Runway 31C, Departures on 31C and 22L *Frequency of Use: 50% in IFR conditions*	Instrument approaches, radar separation	**61-64**
	New Runway	N/A		**N/A**
	Planned improvements (2013)	Same		**61**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

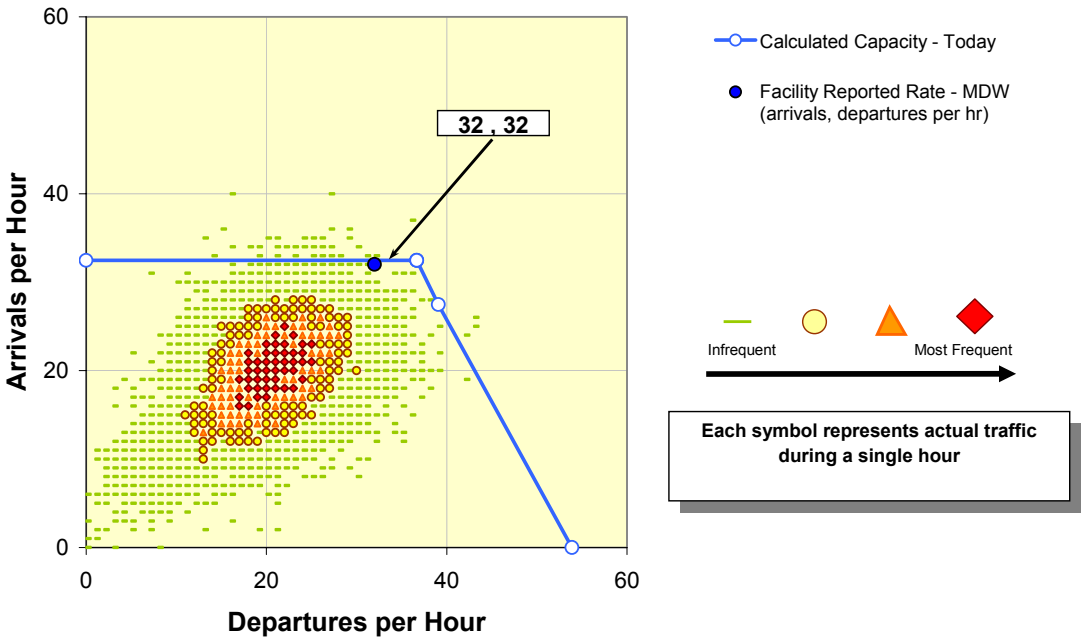
Planned Improvements at MDW include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Airspace redesign. It is assumed that this redesign will allow reduced separations in Optimum and Marginal conditions.

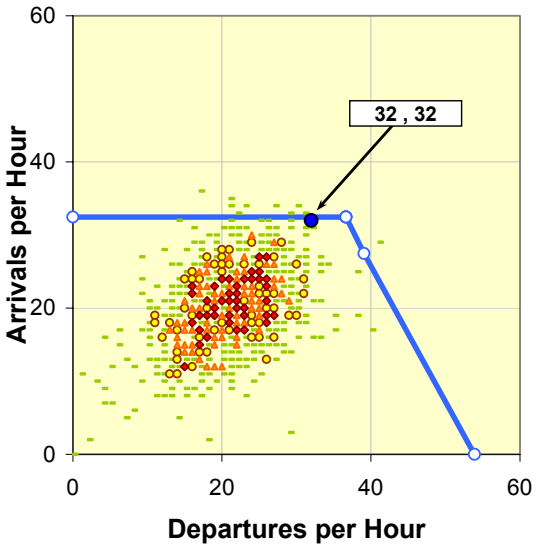
Additional information on these improvements may be found in the Introduction and Overview of this report, under "Assumptions."

Calculated Capacity (Today) and Actual Throughput

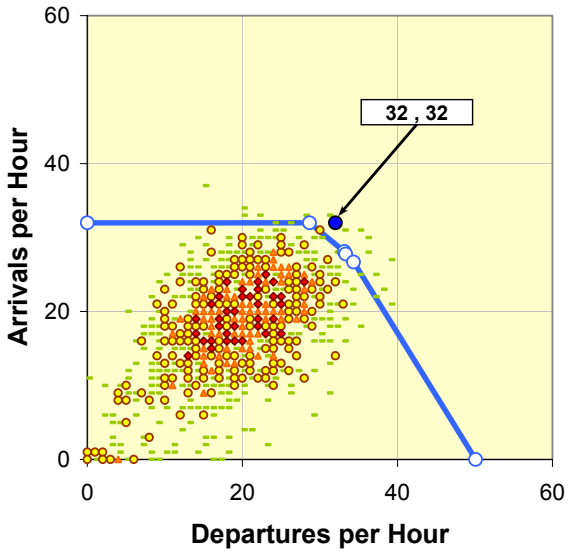
Optimum Rate



Marginal Rate

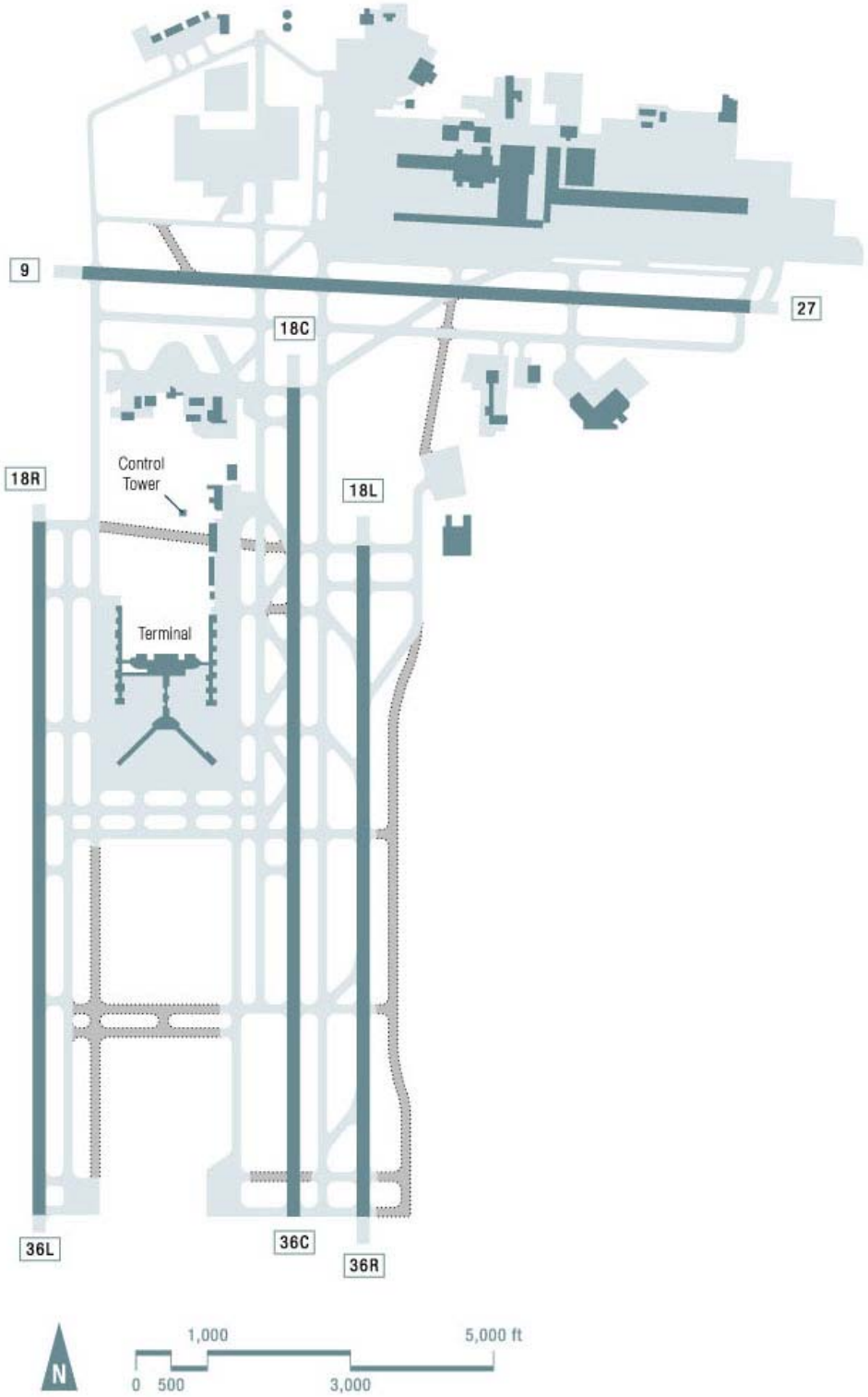


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at MDW.

MEMPHIS – Memphis International (MEM)



Benchmark Results

- The capacity benchmark for Memphis International Airport today is 148-181 flights per hour (arrivals and departures) in Optimum weather.
- The benchmark rate decreases in Marginal conditions to 140-167 flights per hour, and in IFR conditions to 120-132 flights per hour, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, demand is less than capacity, or non-runway constraints (such as airspace restrictions) limit operations.
- At MEM, Runway 27 can be used for arrivals independently of arrivals and departures to the north, if visual separation can be applied. In south flow, Runway 27 operations are limited to smaller aircraft types. This provides a significant capacity benefit in Optimum and Marginal conditions.
- Note that these benchmark rates do not represent balanced operations. Rather, the benchmarks include more arrivals than departures in all weather scenarios. Greater throughput may be possible during departure peaks. Traffic at MEM is characterized by periods of strong arrival demand alternating with periods of strong departure demand, but few periods of balanced demand.
- If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- Planned technological improvements at MEM would increase the benchmark rate by 4-13 percent. Throughput during arrival peaks will increase even more. This increase derives mainly from improved delivery accuracy that is assumed to result from advanced TMA and RNAV procedures. Another planned improvement, CEFR, is expected to allow suitably equipped aircraft to achieve visual separations in Marginal conditions.
- The following charts compare actual hourly traffic with the calculated capacity curves for MEM.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

MEMPHIS – Memphis International Airport (MEM)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 36L, 36R, 27 Departures on 36L, 36C *Frequency of Use: 55% in Optimum conditions*	Visual approaches, visual separation	**148-181**
Ceiling and visibility above minima for visual approaches (5000 ft ceiling and 5 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 76%	**Planned improvements (2013)**	Same		**191**
Marginal Rate	**Today**	Arrivals on Runways 36L, 36R, 27 Departures on 36L, 36C *Frequency of Use: 50% in Marginal conditions*	Instrument approaches, visual separation	**140-167**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 17%	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**190**
IFR Rate	**Today**	Arrivals on Runways 36L, 36R Departures on 36L, 36C *Frequency of Use: 59% in IFR conditions*	Instrument approaches, radar separation	**120-132**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 7%	**Planned improvements (2013)**	Same		**125**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

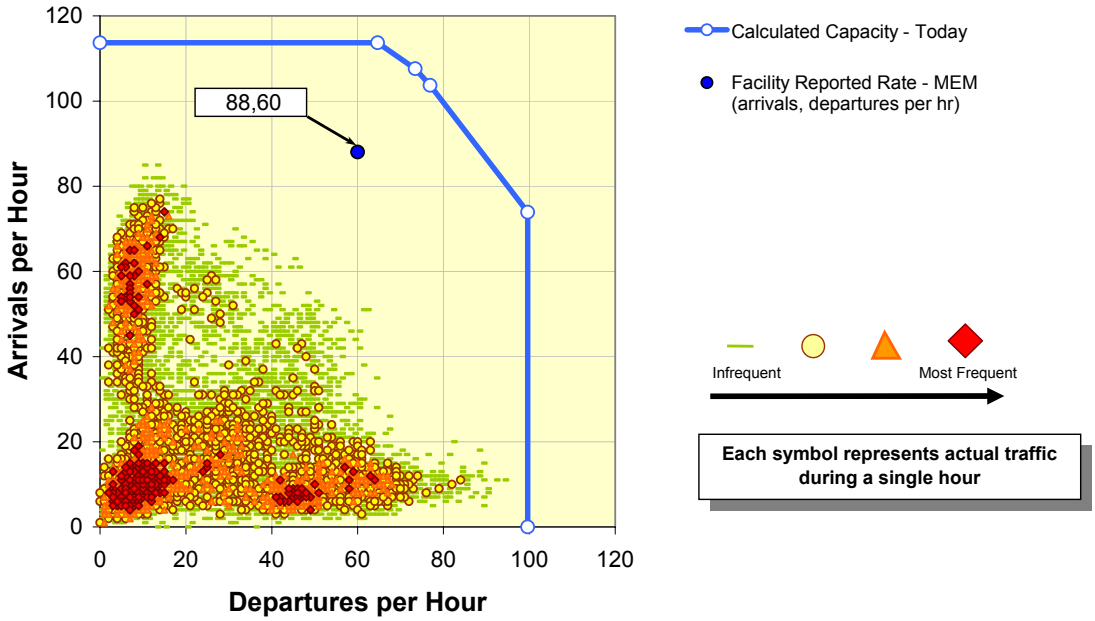
Planned Improvements at MEM include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Advanced TMA/RNAV, to improve delivery accuracy and help MEM consistently utilize available capacity.

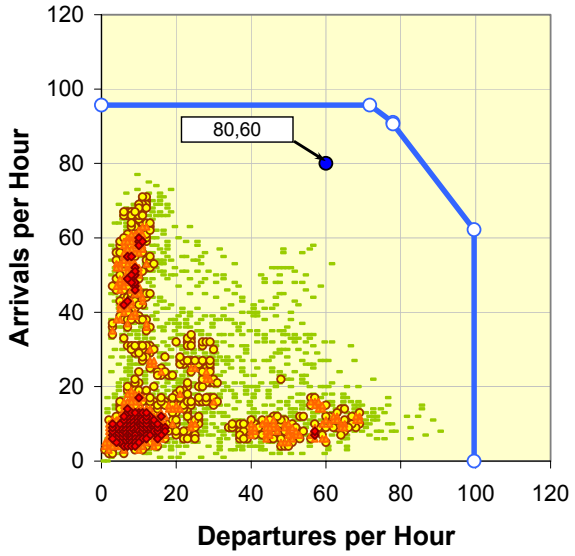
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

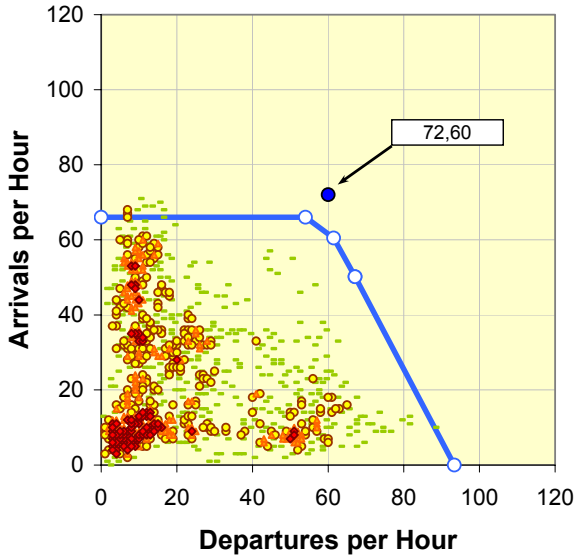
Optimum Rate



Marginal Rate

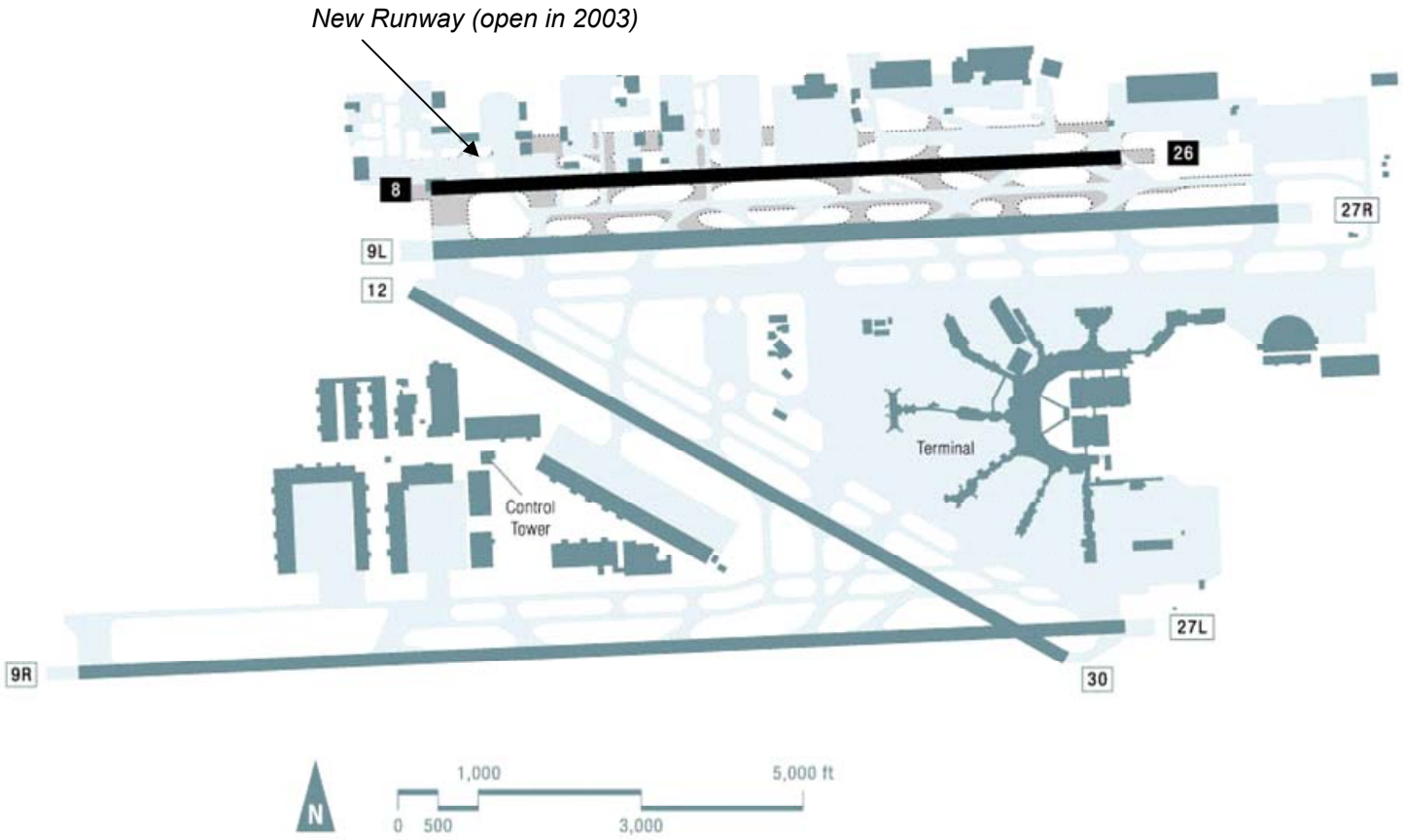


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at MEM.

MIAMI – Miami International (MIA)



Note: *as of 15 April 2004 the runway numbers have changed*

Benchmark Results

- The capacity benchmark for Miami International Airport today is 116-121 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark rate is 104-118 flights per hour in Marginal conditions, and 92-96 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. However Marginal and IFR conditions rarely occur at MIA. Throughput may be less when conditions force the use of other configurations, or during thunderstorms.
- Note that these benchmarks do not always represent balanced operations. Rather, there are more arrivals than departures in the Optimum scenarios, and more departures than arrivals in the IFR scenario. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- A new runway was opened at MIA in 2003. Although the new runway is primarily used for arrivals, it does not increase the maximum airport arrival rate. Rather it allows for more departures without reducing the arrival rate.
- As of 15 April 2004, Runway 9R/27L was renumbered 9/27, and Runway 9L/27R was renumbered 8R/26L. The new runway, 8/26, then became 8L/26R. However, the former runway numbers are used in the following table since it is based on information collected prior to the change.
- Other planned technological improvements at MIA, such as advanced TMA, CEFR, and intersecting runway procedures would increase the benchmark capacity in all conditions. The primary benefit in Marginal conditions assumes all arrivals can use CEFR to achieve visual separations. Additional operations in Optimum conditions can be achieved using intersecting runway procedures. The benefit in IFR conditions derives mainly from improved delivery accuracy that is assumed to result from advanced TMA and RNAV procedures.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

MIAMI – Miami International Airport (MIA)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate Ceiling and visibility above minima for visual approaches (2000 ft ceiling and 5 mi visibility) *Occurrence: 95%*	**Today**	Arrivals on 9R, 9L, 12 Departures on 9R, 9L, 12 *Frequency of Use: 78% in Optimum conditions*	Visual approaches, visual separation	**116-121**
	New Runway (2003)	Arrivals on 9R, 8, 12 Departures on 9R, 9L, 12		**149**
	Planned improvements (2013), including new runway	Same	Visual approaches, visual separation, intersecting runway procedures	**154**
Marginal Rate Below visual approach minima but better than instrument conditions *Occurrence: 3%*	**Today**	Arrivals on 9R, 9L, 12 Departures on 9R, 9L, 12 *Frequency of Use: 55% in Marginal conditions*	Instrument approaches, visual separation	**104-118**
	New Runway (2003)	Arrivals on 9R, 8, 12 Departures on 9R, 9L, 12		**126**
	Planned improvements (2013), including new runway	Same	Visual approaches, visual separation	**152**
IFR Rate Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles) *Occurrence: 2%*	**Today**	Arrivals on 9R, 9L Departures on 9R, 9L, 12 *Frequency of Use: 65% in IFR conditions*	Instrument approaches, radar separation	**92-96**
	New Runway (2003)	Arrivals on 9R, 8 Departures on 9R, 9L, 12		**114**
	Planned improvements (2013), including new runway	Same		**120**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

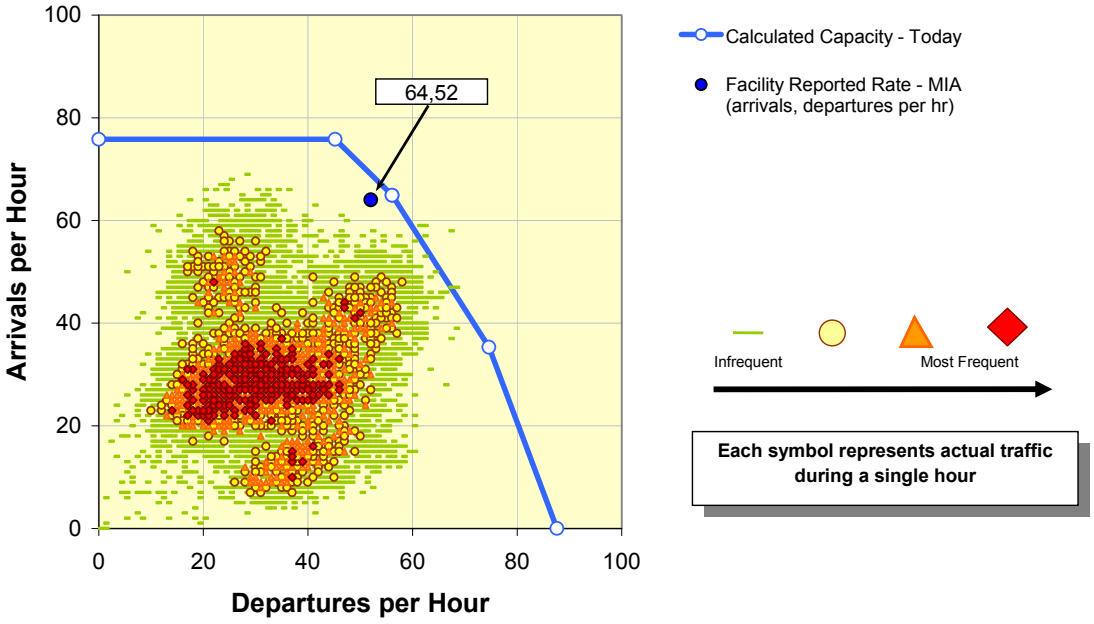
Planned Improvements at MIA include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Intersecting runway procedures in Optimum conditions.
- Advanced TMA/RNAV, to improve delivery accuracy and help MIA consistently utilize available capacity in all conditions.

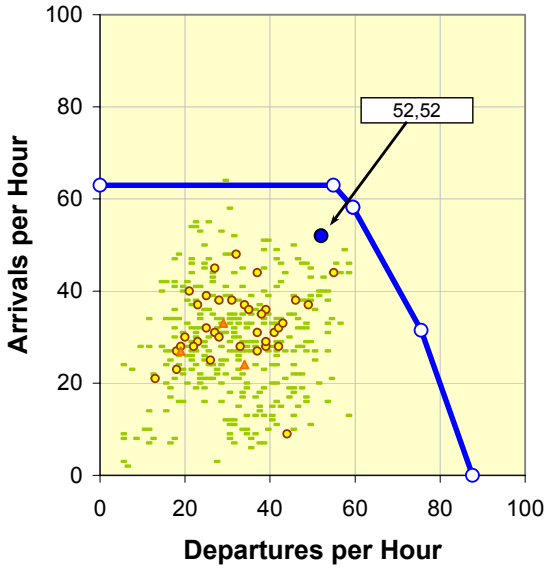
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

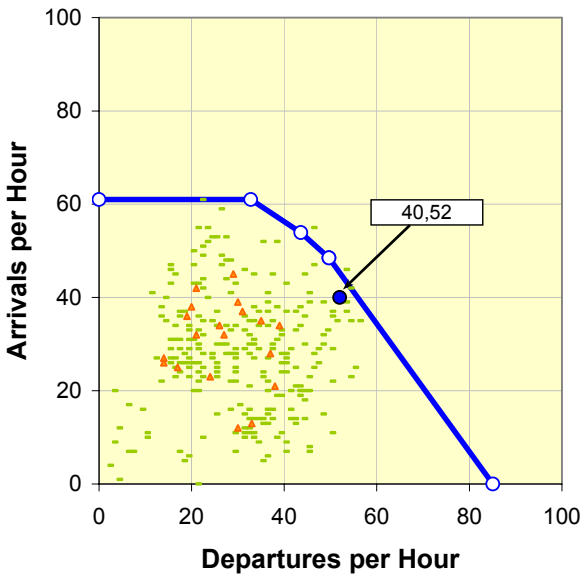
Optimum Rate



Marginal Rate

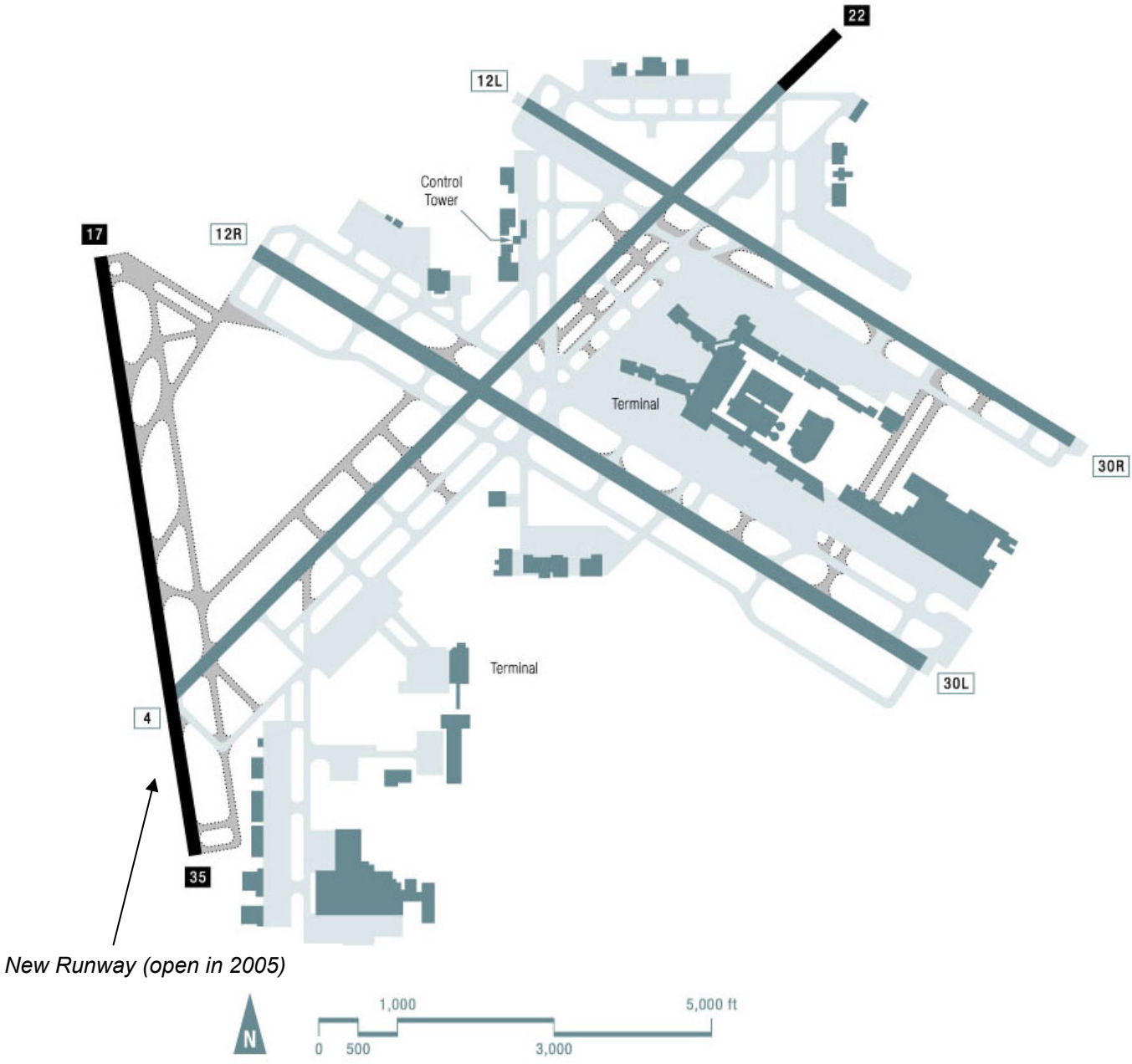


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at MIA.

MINNEAPOLIS-ST. PAUL – Minneapolis-St. Paul International (MSP)



Benchmark Results

- The capacity benchmark for Minneapolis-St. Paul International Airport today is 114-120 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark rate falls to 112-115 flights per hour in Marginal conditions, and 112-114 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. These benchmark values assume that the Precision Runway Monitor (PRM) system at MSP is operational, which makes simultaneous independent approaches possible in bad weather.
- These benchmark rates represent balanced operations, with equal numbers of arrivals and departures per hour. Greater total throughput may be possible during arrival or departure peaks.
- A new runway, Runway 17/35, is planned for completion in 2005. In Optimum and Marginal conditions this new runway will be used for departures to the south during departure peaks or arrivals from the south in an arrival push. It is expected that in IFR conditions the runway will be used for departures to the south. This assumes that airspace, ground infrastructure, and environmental constraints allow the planned use of the new runway.
- Other planned technological improvements at MSP such as advanced TMA would increase the benchmark rate in all conditions. The benefit in Marginal conditions assumes all arrivals can use CEFR to achieve visual separations. The benefit in Optimum and IFR conditions derives mainly from improved delivery accuracy that is assumed to result from advanced TMA and RNAV procedures.
- In the following charts, please note that a number of hourly traffic points fall outside the calculated capacity curves at MSP. There are many possible reasons why this may occur without affecting operational safety, including operation on a different runway configuration than the one modeled. Efficient aircraft sequencing or above-average pilot and controller performance can contribute to higher throughputs. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing the use of different ATC procedures.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

MINNEAPOLIS-ST. PAUL – Minneapolis-St. Paul International Airport (MSP)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on 30R, 30L Departures on 30R, 30L *Frequency of Use: 59% in Optimum conditions*	Independent parallel visual approaches, visual separation	**114-120**
Ceiling and visibility above minima for visual approaches (3500 ft ceiling and 8 mi visibility)	**New Runway (2005)**	Arrivals on 30R, 30L, 35 Departures on 30R, 30L, 17		**160**
Occurrence: 64%	**Planned improvements (2013), including new runway**	Same		**167**
Marginal Rate	**Today**	Arrivals on Runways 30R, 30L Departures on 30R, 30L *Frequency of Use: 55% in Marginal conditions*	Independent parallel instrument approaches, visual separation	**112-115**
Below visual approach minima but better than instrument conditions	**New Runway (2005)**	Arrivals on 30R, 30L, 35 Departures on 30R, 30L, 17		**155**
Occurrence: 28%	**Planned improvements (2013), including new runway**	Same	Independent parallel visual approaches, visual separation	**167**
IFR Rate	**Today**	Arrivals on 12R, 12L Departures on 12R, 12L *Frequency of Use: 64% in IFR conditions*	Independent parallel instrument approaches, radar separation	**112-114**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway (2005)**	Arrivals on 30R, 30L Departures on 30R, 30L, 17		**125**
Occurrence: 8%	**Planned improvements (2013), including new runway**	Same		**137**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

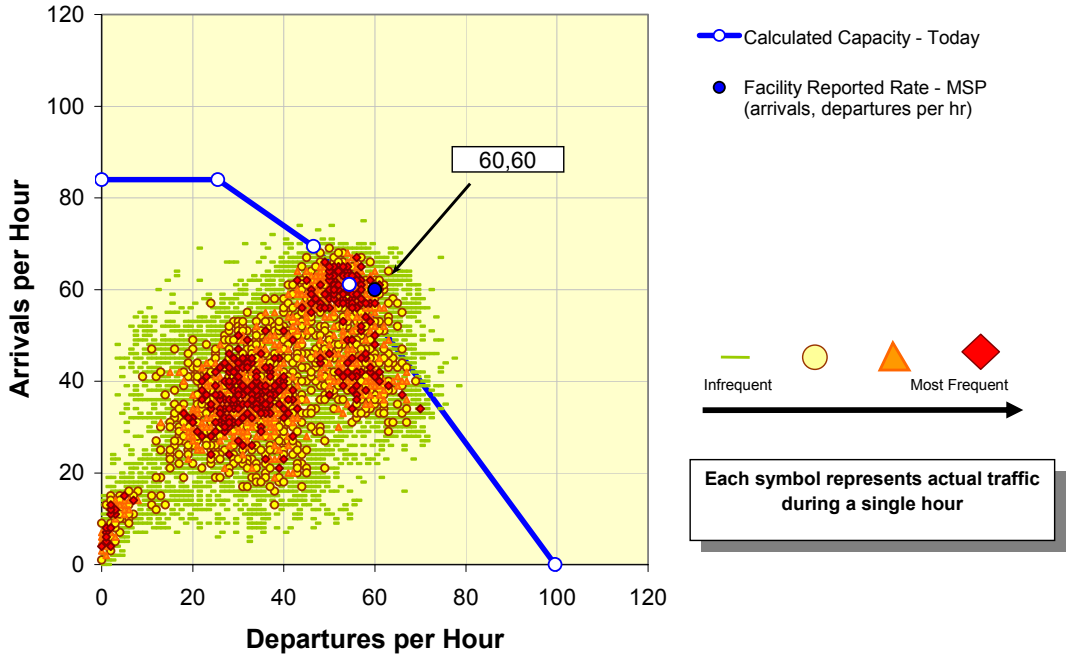
Planned Improvements at MSP include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Advanced TMA/RNAV, to improve delivery accuracy and help MSP consistently utilize available capacity in all conditions.

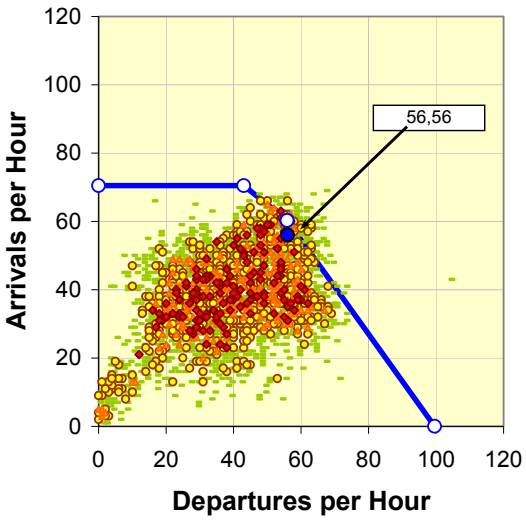
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

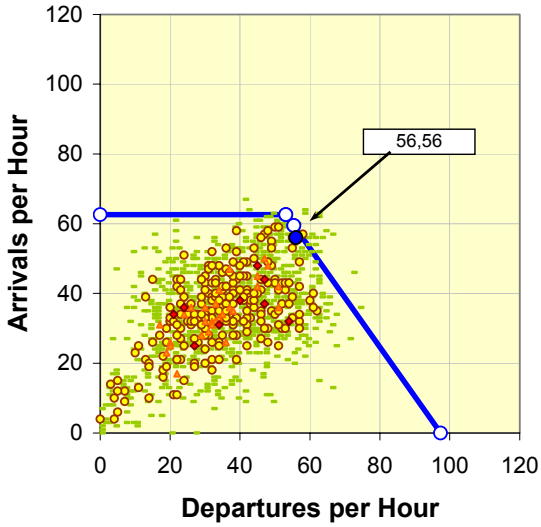
Optimum Rate



Marginal Rate

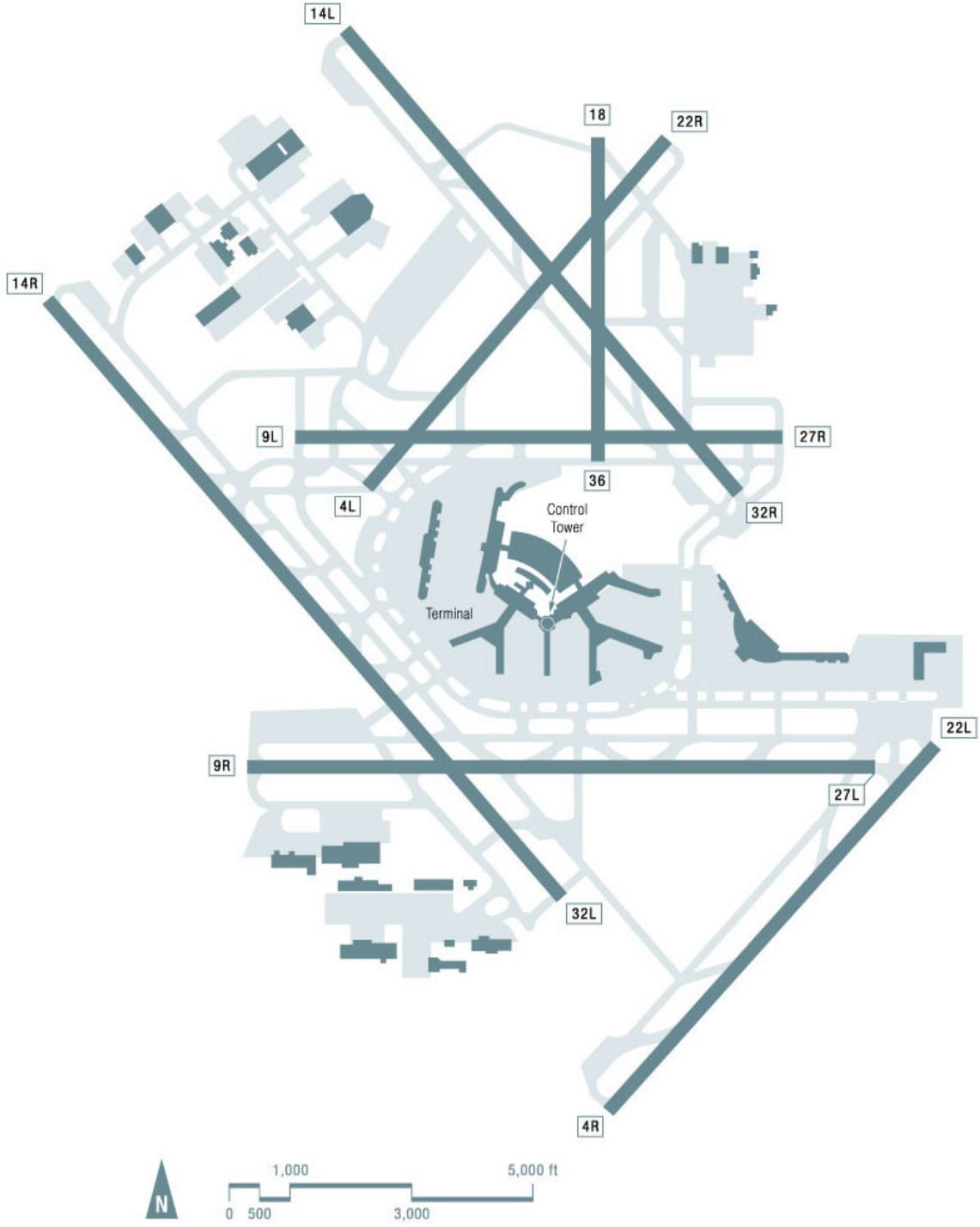


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at MSP.

CHICAGO – Chicago O'Hare International (ORD)



Note: *Runway 18/36 at ORD has been decommissioned.*

Benchmark Results

- The capacity benchmark for Chicago O'Hare International Airport today is 190-200 flights per hour (arrivals and departures) in Optimum and Marginal weather.
- The FAA facility at ORD reported a rate of 100 arrivals and 100 departures per hour in Optimum and Marginal conditions when the most common runway configuration was in use. Procedural changes at ORD since January 2003 have reduced the frequency of occurrence of these rates. The average acceptance rate will be lower, since wind conditions frequently force the use of other configurations with lower rates. Arrival and departure rates may also be affected by traffic flow control measures, such as mile-in-trail restrictions caused by en route weather or airspace constraints.
- The benchmark rate decreases in IFR conditions to 136-144 flights per hour, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, or when a less-favorable runway configuration is in use. Alternatively, other runway configurations may provide higher capacity.
- Note that these benchmark rates represent balanced operations. Greater throughput may be possible during arrival or departure peaks.
- Planning is underway for an extensive reconfiguration of ORD. The O'Hare Modernization Plan (OMP) envisions six parallel runways and triple simultaneous instrument approaches. These changes would significantly increase the benchmark rate at ORD. However, environmental studies are still underway, and the FAA has not issued a Record of Decision (ROD) for the new runways. The proposed new runways were not included in OEP v5.0. Therefore, the effect of the OMP has not been included in this analysis.
- Planned technological improvements at ORD include CEFR, which could allow suitably equipped aircraft to achieve visual separations in Marginal conditions. However, CEFR is not expected to have a significant effect on the benchmark rates at ORD, since radar separations are typically used even in Optimum conditions.
- Another planned improvement at ORD is revised procedures for operations on intersecting runways. However, these revised procedures were not considered in determining the benchmarks, because insufficient information on the procedures was available to determine whether they would apply to the configurations modeled, or what the effect would be.
- In the following charts, please note that some hourly traffic points fall outside the calculated capacity curves at ORD. There are many possible reasons why this may occur without affecting operational safety. Efficient aircraft sequencing or above-average pilot and controller performance can contribute to higher throughputs. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

CHICAGO – Chicago O'Hare International Airport (ORD)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 9L, 9R, 4R Departures on 32L, 32R, 4L, 9L *Frequency of Use: 35% in Optimum conditions*	Instrument approaches, radar separation	**190-200**
Ceiling and visibility above minima for visual approaches (1900 ft ceiling and 3 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 84%	**Planned improvements (2013)**	Same		**190**
Marginal Rate	**Today**	Arrivals on Runways 9L, 9R, 4R Departures on 32L, 32R, 4L, 9L *Frequency of Use: 36% in Marginal conditions*	Instrument approaches, radar separation	**190-200**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 7%	**Planned improvements (2013)**	Same		**190**
IFR Rate	**Today**	Arrivals on Runways 9L, 9R Departures on 32L, 32R, 4L, 9L *Frequency of Use: 31% in IFR conditions*	Instrument approaches, radar separation	**136-144**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 9%	**Planned improvements (2013)**	Same		**136**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

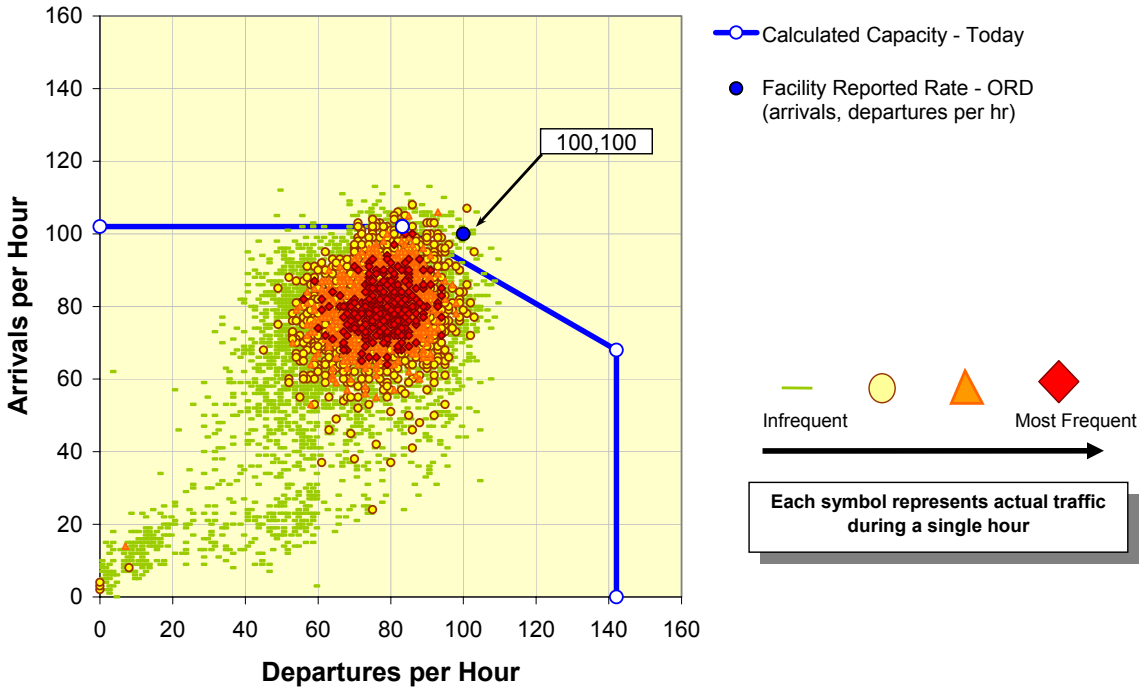
Planned Improvements at ORD include:

- CEFR, for visual approaches in Marginal conditions.
- Improved intersecting runway procedures.

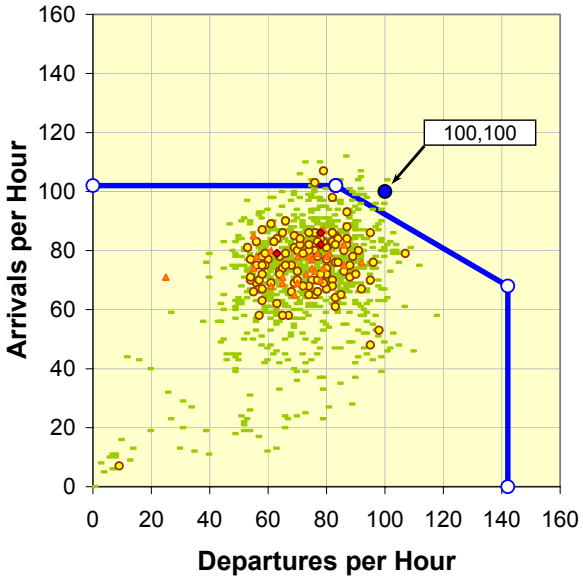
Additional information on these improvements may be found in the Introduction and Overview of this report, under "Assumptions."

Calculated Capacity (Today) and Actual Throughput

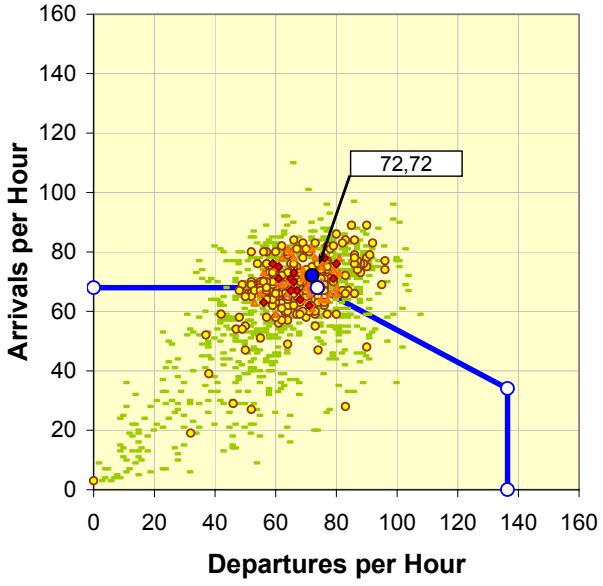
Optimum Rate



Marginal Rate

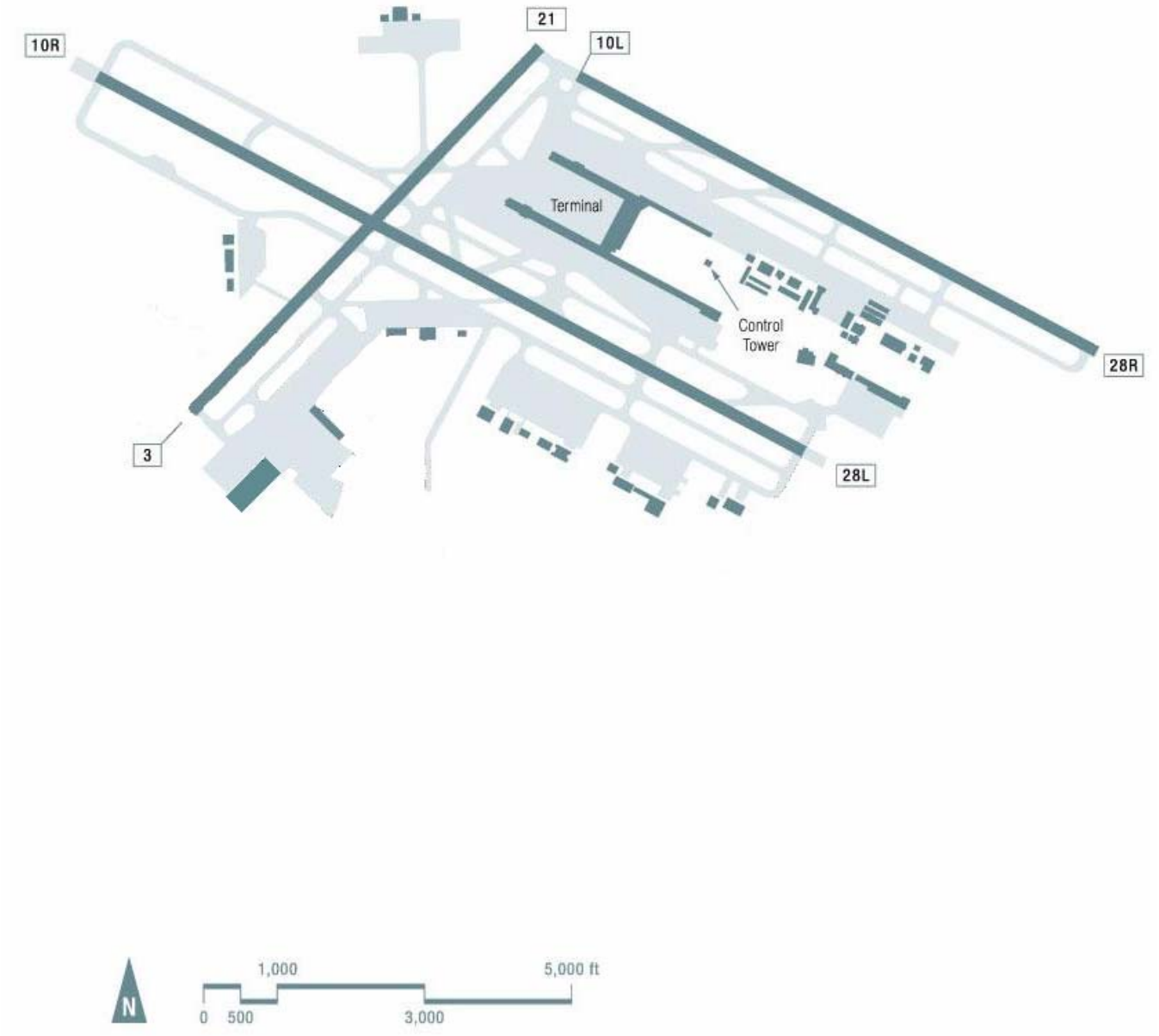


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at ORD.

PORTLAND – Portland International (PDX)



Benchmark Results

- The capacity benchmark for Portland International Airport today is 116-120 flights per hour (arrivals and departures) in Optimum weather.
- The benchmark rate decreases in Marginal conditions to 79-80 flights per hour, and in IFR conditions to 77-80 flights per hour, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, or when IFR operations at nearby airports affect PDX operations.
- Note that these benchmarks represent balanced operations. Greater throughput may be possible during arrival or departure peaks.
- Most departures from both runways at PDX are limited to a single departure corridor for noise abatement. Estimation of the future benchmark assumed that this noise abatement procedure was in effect. By limiting departure headings, this procedure reduces the maximum departure throughput.
- Other planned technological improvements at PDX would increase the benchmark rate by as much as 38 percent in Marginal conditions. This additional benefit derives from CEFR, which will allow suitably equipped aircraft to maintain visual separations in Marginal conditions. It also assumes that RNP procedures for approach guidance (RPAT) would allow paired approaches to the parallel runways.
- The projected increase in the benchmark rate can occur *only* if the RPAT procedure is proven feasible, and if ground infrastructure, environmental constraints, and airborne equipment requirements are satisfied. The increase in actual operations may be less if airspace restrictions prevent full use of the procedure.
- The following charts compare actual hourly traffic with the calculated capacity curves for PDX.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

PORTLAND – Portland International Airport (PDX)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate Ceiling and visibility above minima for visual approaches (3500 ft ceiling and 8 mi visibility) *Occurrence: 75%*	**Today**	Arrivals on Runways 28R, 28L Departures on 28R, 28L *Frequency of Use: insufficient data*	Visual approaches, visual separation Restricted departure headings for noise abatement	**116-120**
	New Runway	N/A		**N/A**
	Planned improvements (2013)	Same		**116**
Marginal Rate Below visual approach minima but better than instrument conditions *Occurrence: 21%*	**Today**	Arrivals on Runways 10R, 10L Departures on 10R, 10L *Frequency of Use: insufficient data*	Dependent instrument approaches, radar separation Simultaneous departures, restricted departure headings for noise abatement	**79-80**
	New Runway	N/A		**N/A**
	Planned improvements (2013)	Same	Paired approaches, visual separation Same departure procedures	**109**
IFR Rate Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles) *Occurrence: 4%*	**Today**	Arrivals on Runways 10R, 10L Departures on 10R, 10L *Frequency of Use: insufficient data*	Dependent instrument approaches, radar separation Simultaneous departures, restricted departure headings for noise abatement	**77-80**
	New Runway	N/A		**N/A**
	Planned improvements (2013)	Same		**77**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

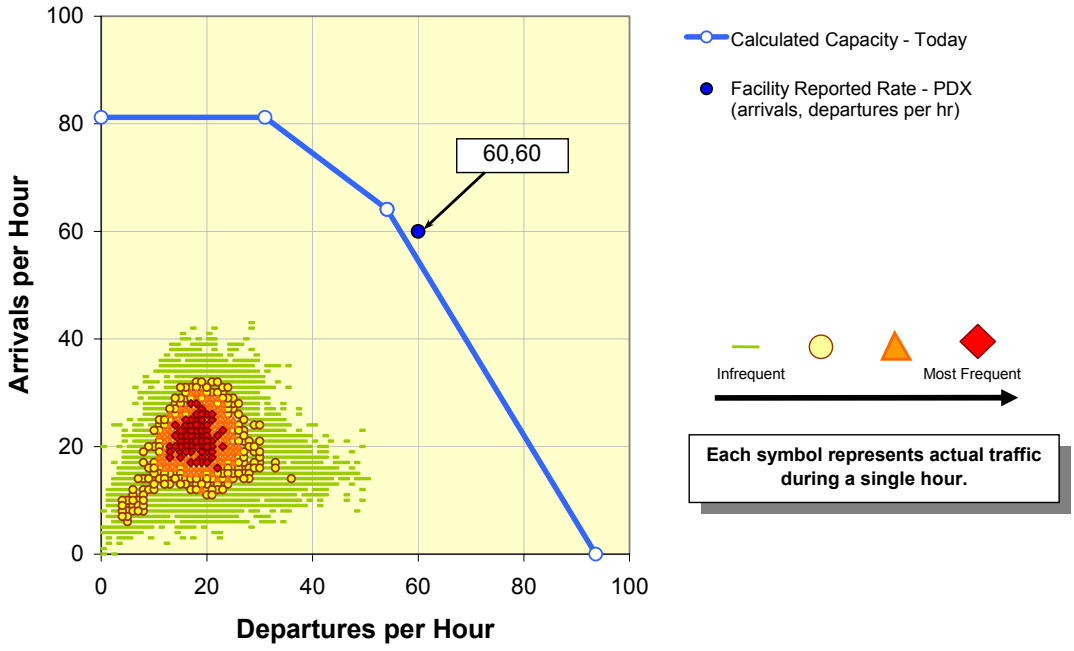
Planned Improvements at PDX include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- RNP Approach Transition (RPAT) procedures, to allow paired instrument approaches to a visual final approach in Marginal conditions.

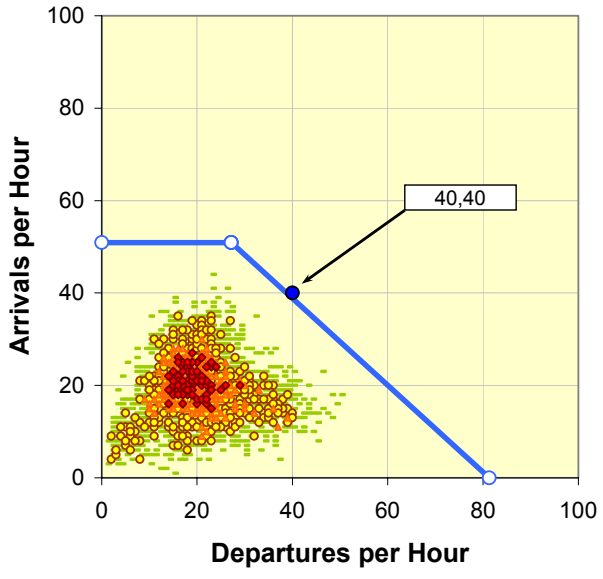
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

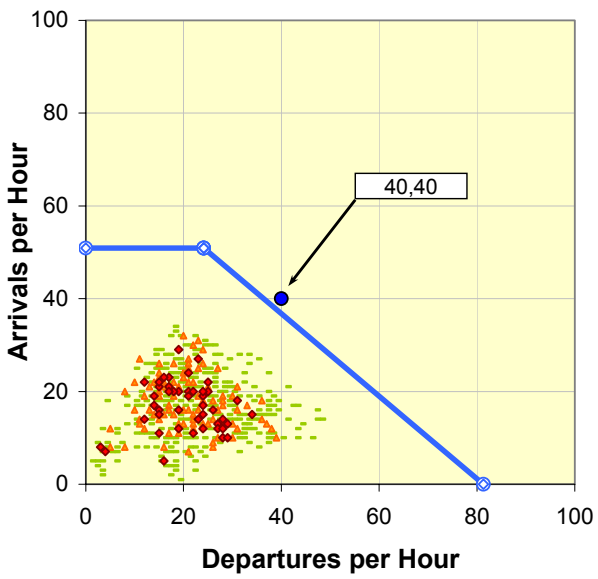
Optimum Rate



Marginal Rate

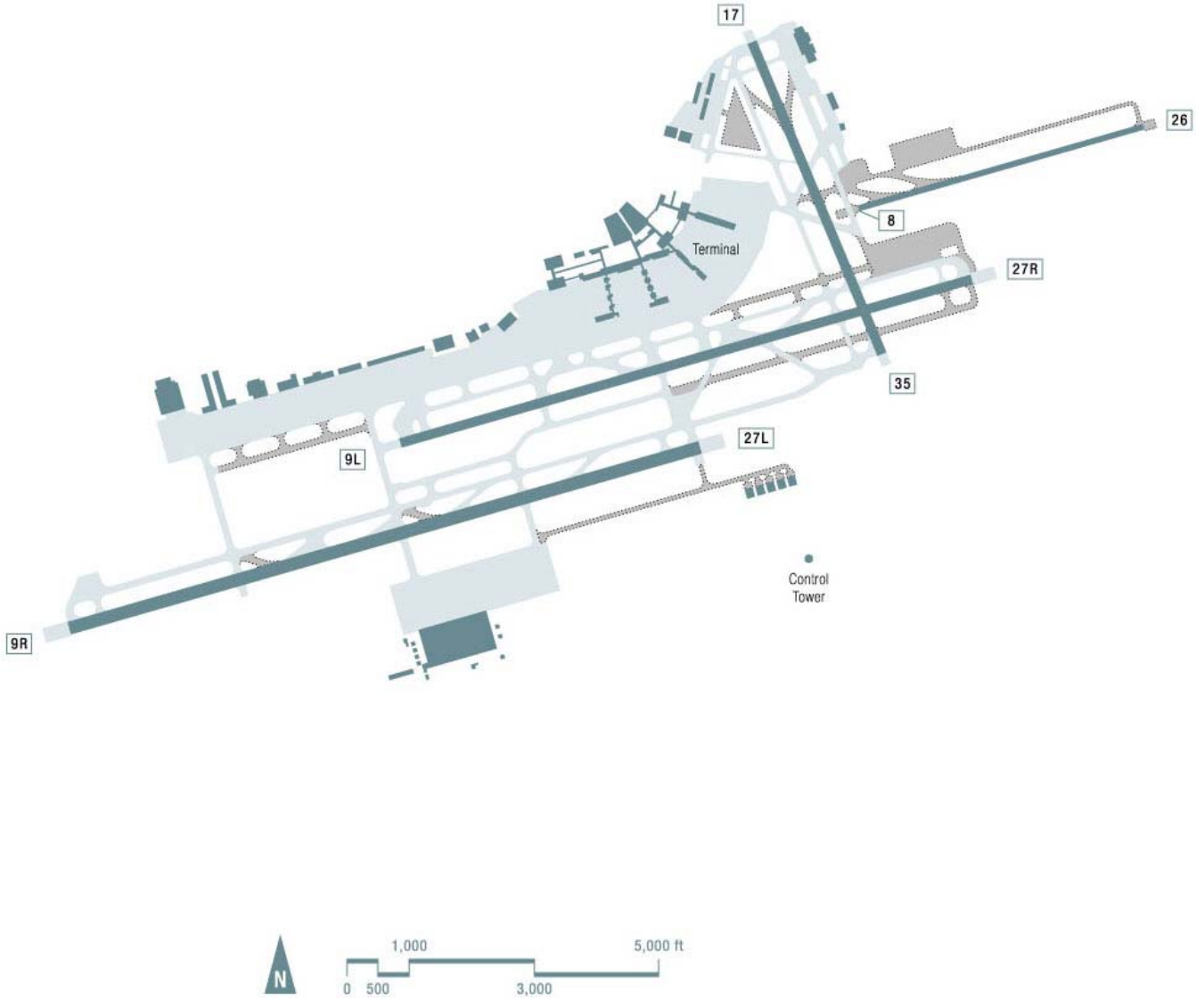


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at PDX.

PHILADELPHIA – Philadelphia International (PHL)



Benchmark Results

- The capacity benchmark for Philadelphia International Airport today is 104-116 flights per hour (arrivals and departures) in Optimum weather.
- The benchmark rate decreases in Marginal conditions to 96-102 flights per hour, and in IFR conditions to 96 flights per hour, for the most commonly used runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, when a less-favorable runway configuration is in use, or when fewer than average aircraft are available to use Runways 17/35 and 08/26.
- At PHL, general aviation and commuter aircraft will typically use Runway 17/35, Runway 08 (for departure) or Runway 26 (for arrival). Air carrier aircraft will use the main parallel runways, Runways 09R/27L and 09L/27R.
- Note that these benchmarks represent balanced operations. Greater throughput may be possible during arrival or departure peaks.
- Planning is underway for an extensive reconfiguration of PHL, with several alternatives under consideration. These changes could significantly increase the benchmark capacity at PHL. However, environmental studies are required before the FAA issues a Record of Decision (ROD) for any new runways. This possible reconfiguration was not included in OEP v5.0, and therefore the effect of any reconfiguration was not included in this analysis.
- Planned technological improvements at PHL include CEFR, which would increase the benchmark rate by as much as 7 percent in Marginal conditions by allowing suitably equipped arrivals to maintain visual separation. It also assumes that RNP procedures for approach guidance (RPAT) would allow paired approaches to the parallel runways.
- The benchmark values do not include any benefit due to the PRM system installed at PHL, because the runway configurations that would make use of PRM are not the most commonly used configurations.
- Future procedures at PHL may include paired approaches to the main parallel runways, based on either SOIA or RPAT. Arrivals to both runways, or departures from both runways, could also benefit from proposed changes to current wake vortex procedures. However, the runway configurations that are currently used most often at PHL would not utilize these new procedures, and so they did not affect the benchmark rates.
- In the following charts, please note that some hourly traffic points fall outside the calculated capacity curves at PHL. There are many possible reasons why this may occur without affecting operational safety. Higher throughputs may be possible through more efficient sequencing of aircraft, or when pilot and controller performance is better than average. Also, more than the average number of aircraft may have been able to use the secondary runways, 17/35 and 08/26, during these hours.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

PHILADELPHIA – Philadelphia International Airport (PHL)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 27R (26, 35) Departures on 27L (35) *Frequency of Use: 58% in Optimum conditions*	Visual approaches using CRDA, visual separation	**104-116**
Ceiling and visibility above minima for visual approaches (2300 ft ceiling and 4 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 86%	**Planned improvements (2013)**	Same		**116**
Marginal Rate	**Today**	Arrivals on Runways 09R (17) Departures on 09L (08, 17) *Frequency of Use: 45% in Marginal conditions*	Independent converging instrument approaches, radar and visual separation	**96-102**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 6%	**Planned improvements (2013)**	Same		**109**
IFR Rate	**Today**	Arrivals on Runways 09R (17) Departures on 09L (08, 17) *Frequency of Use: 30% in IFR conditions*	Independent converging instrument approaches, radar separation	**96**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 8%	**Planned improvements (2013)**	Same		**96**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

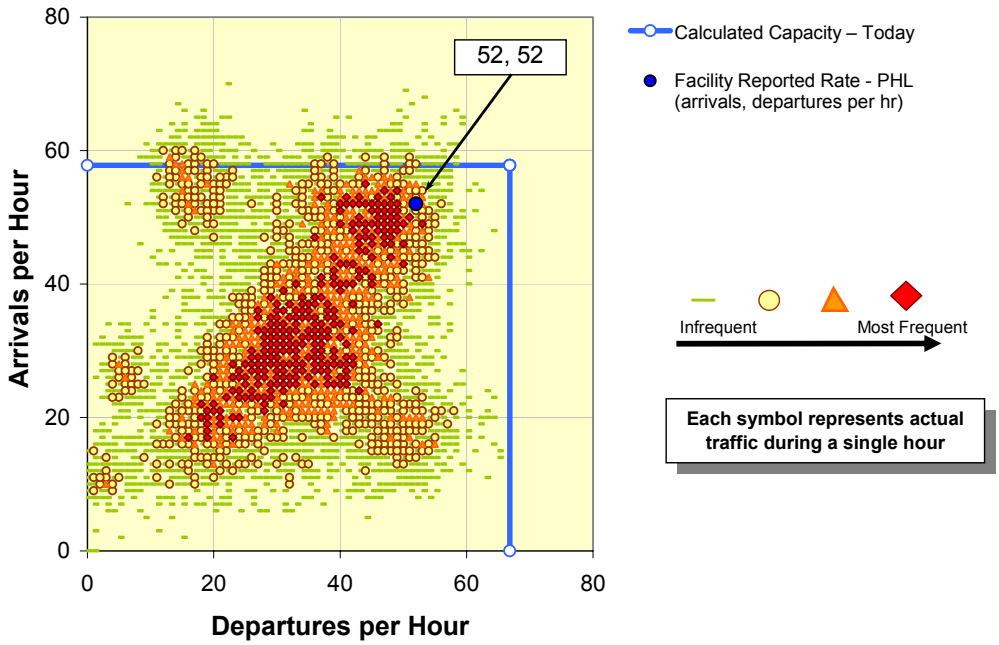
Planned Improvements at PHL include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- RNP Approach Transition (RPAT) procedures, to allow paired instrument approaches to a visual final approach in Marginal conditions.
- Improved wake vortex procedures, for reduced separation between consecutive arrivals or consecutive departures to the close parallel runways 18R/36L and 18L/36R.

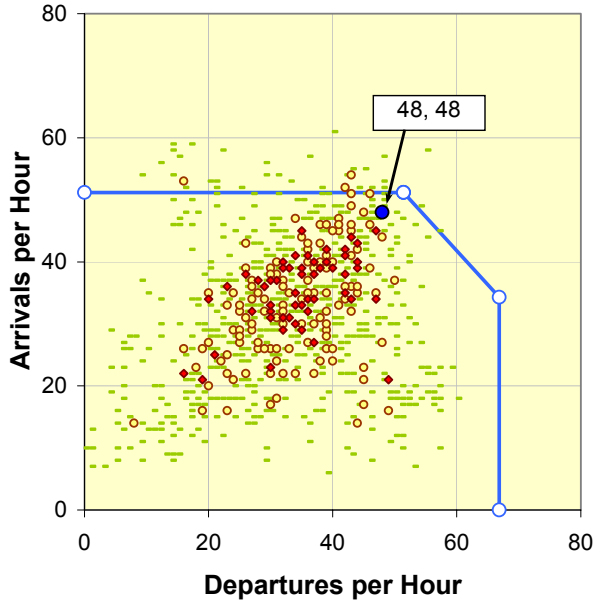
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

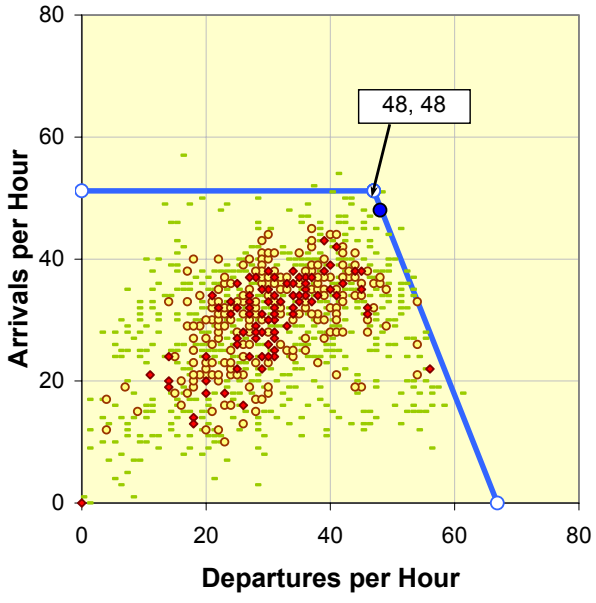
Optimum Rate



Marginal Rate

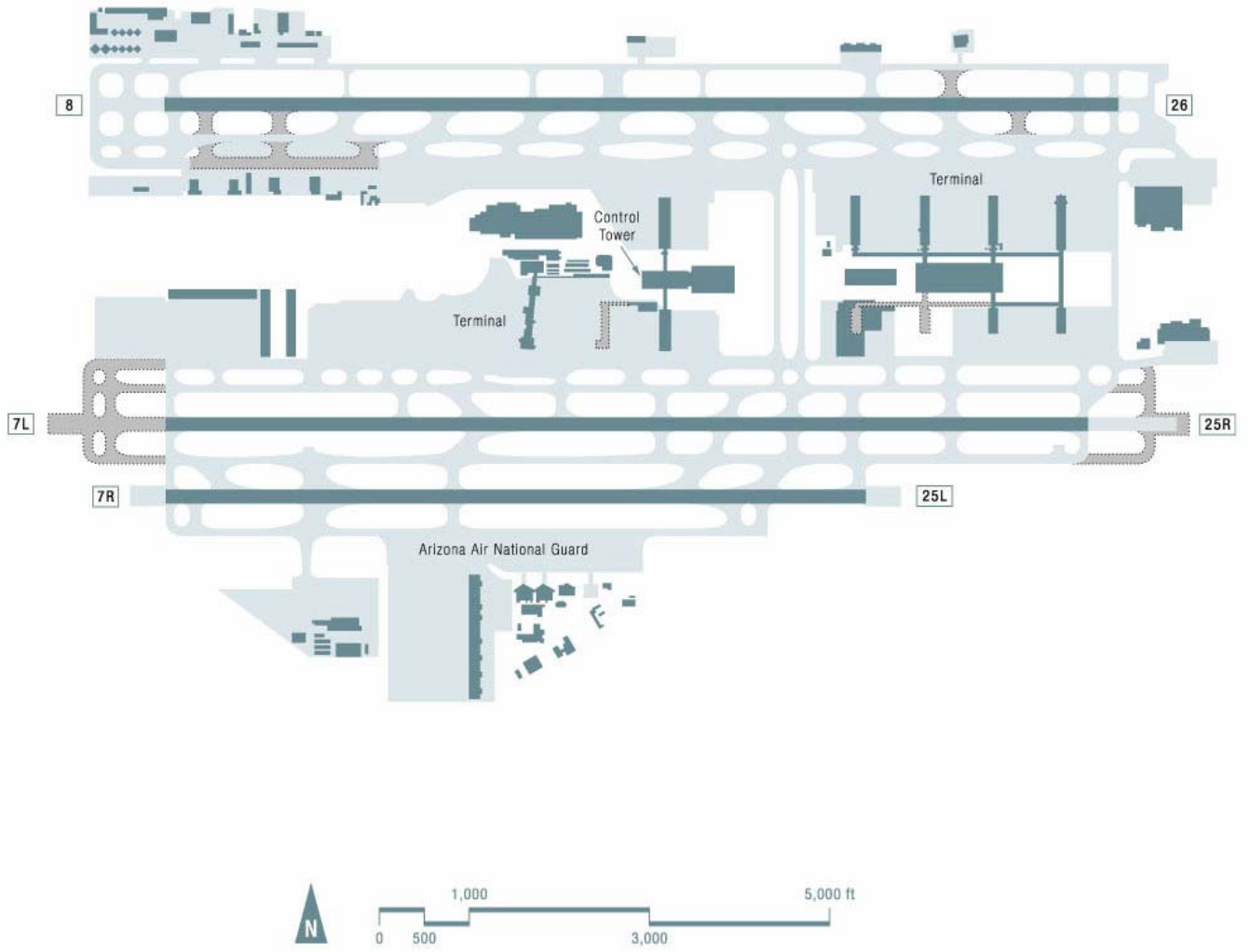


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at PHL.

PHOENIX – Phoenix Sky Harbor International (PHX)



Benchmark Results

- The capacity benchmark for Phoenix Sky Harbor International Airport today is 128-150 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark rate decreases to 108-118 flights per hour in Marginal and IFR conditions, for the most commonly used runway configuration in these conditions. Each scenario represents less than one percent of operations at PHX.
- Note that these benchmark rates do not always represent balanced operations. Rather, there may be more arrivals than departures in the Optimum scenario, and more departures than arrivals in the Marginal and IFR scenarios.
- Departures from PHX are limited by environmental constraints, terrain, and nearby military airspace. It is assumed that these restrictions will continue in the future.
- Planned technological improvements at PHX include CEFR, which will allow suitably equipped aircraft to maintain visual separations in Marginal conditions. This would increase the Marginal benchmark rate at PHX by less than one percent.
- The following charts compare actual hourly traffic with the calculated capacity curves for PHX.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

PHOENIX – Phoenix Sky Harbor International Airport (PHX)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 7R, 8 Departures on 7L *Frequency of Use: 48% in optimum conditions*	Visual approaches, visual separation	**128-150**
Ceiling and visibility above minima for visual approaches (3300 ft ceiling and 7 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 99%	**Planned improvements (2013)**	Same		**150**
Marginal Rate	**Today**	Arrivals on Runways 25L, 26 Departures on 25R *Frequency of Use: 28% in marginal conditions*	Instrument approaches, radar separation	**108-118**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 1%	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**118**
IFR Rate	**Today**	Arrivals on Runways 25L, 26 Departures on 25R *Frequency of Use: 45% in IFR conditions*	Instrument approaches, radar separation	**108-118**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 0%	**Planned improvements (2013)**	Same		**118**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

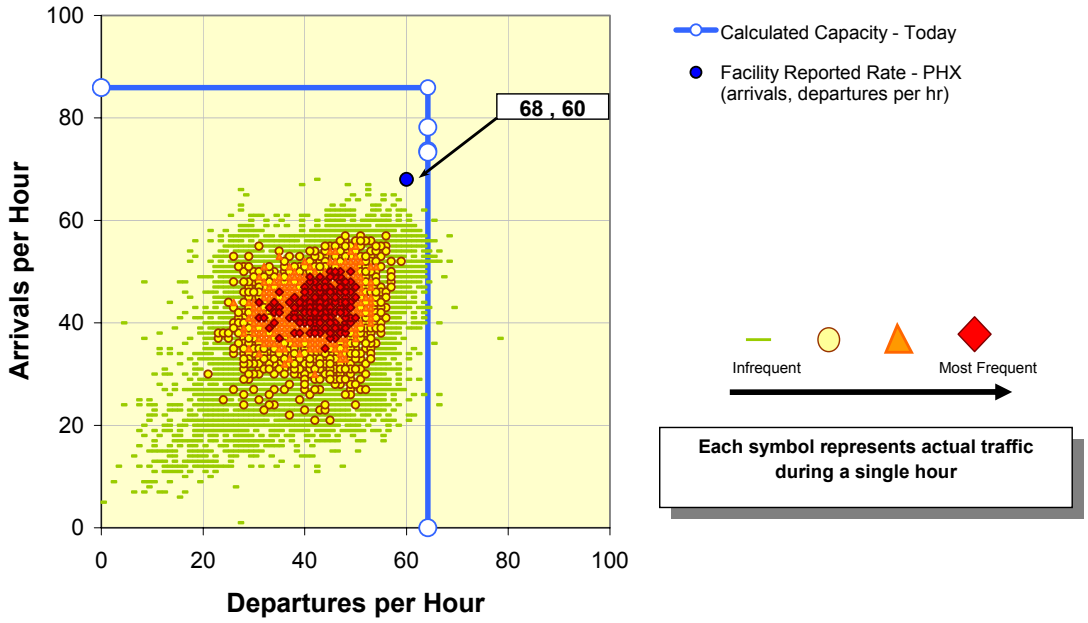
Planned Improvements at PHX include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.

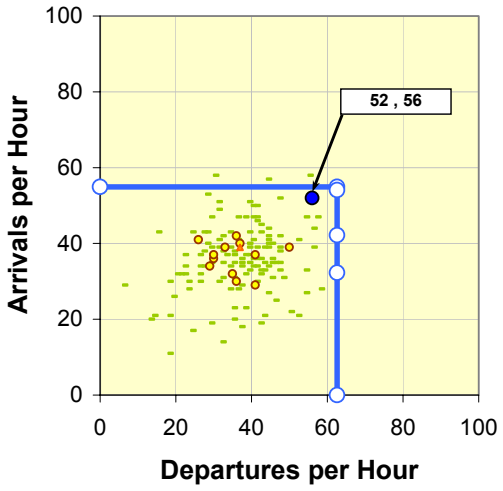
Additional information on this improvement may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

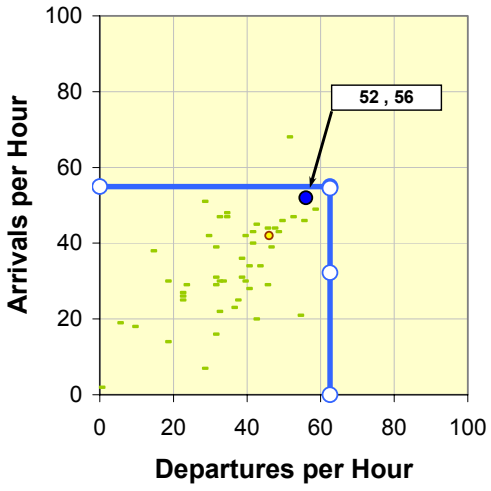
Optimum Rate



Marginal Rate

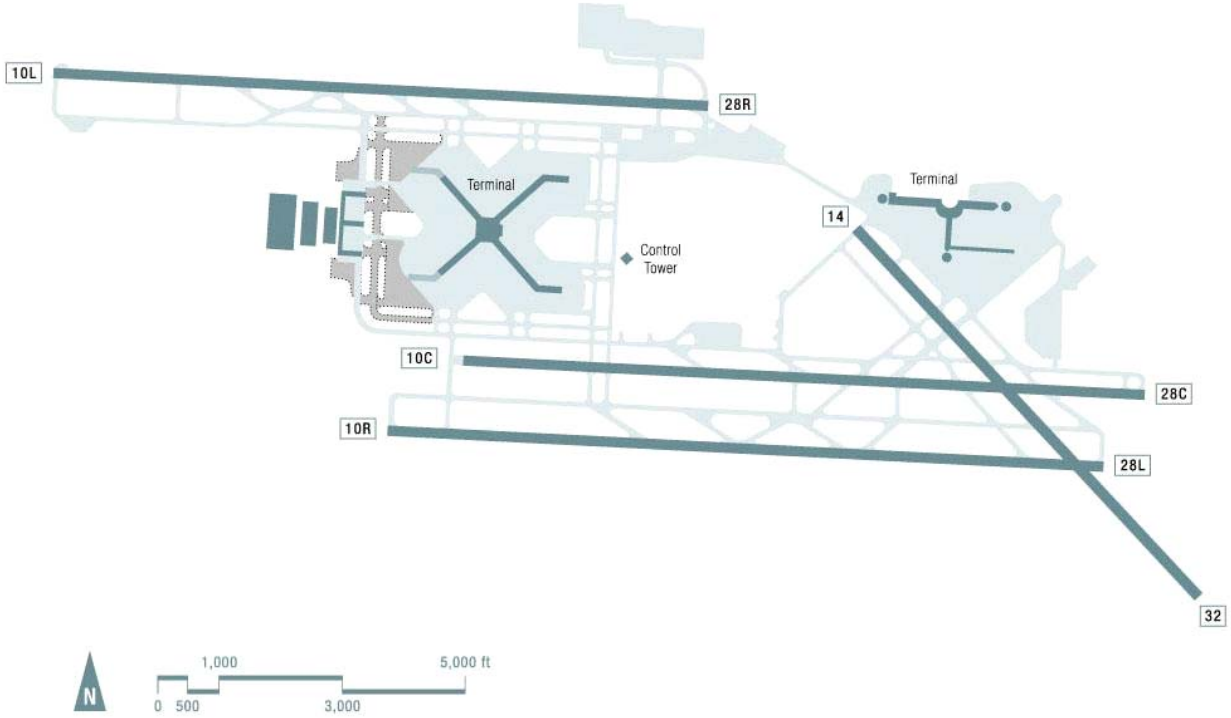


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at PHX.

PITTSBURGH – Greater Pittsburgh International (PIT)



Benchmark Results

- The current capacity benchmark for Greater Pittsburgh International Airport is 152-160 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark rate decreases to 143-150 flights per hour in Marginal conditions, and to 119-150 flights per hour in IFR conditions for the most commonly used runway configuration in these conditions. The upper bound of 150 is the facility-called rate, whereas the lower bounds are the modeled benchmarks for these configurations.
- Note that these benchmarks do not always represent balanced operations – there may be more departures than arrivals in the Marginal and IFR scenarios. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- Planned technological improvements at PIT would slightly increase the arrival peak capacity in Marginal conditions. The benefit in Marginal conditions assumes that suitably equipped aircraft can use CEFR to maintain visual separations, thus allowing the airport to realize the Optimum rate arrival capacity in Marginal conditions.
- The following charts compare actual hourly traffic with the calculated capacity curves for PIT.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

PITTSBURGH – Greater Pittsburgh International Airport (PIT)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 28R, 32 Departures on 28L, 28R *Frequency of Use: 61% in optimum conditions*	Visual approaches, visual separation	**152-160**
Ceiling and visibility above minima for visual approaches (1800 ft ceiling and 3 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 86%	**Planned improvements (2013)**	Same		**152**
Marginal Rate	**Today**	Arrivals on Runways 28L, 28R Departures on 28C, 28R *Frequency of Use: 51% in marginal conditions*	Instrument approaches, radar separation	**143-150**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 5%	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**152**
IFR Rate	**Today**	Arrivals on Runways 28L, 28R Departures on 28C, 28R *Frequency of Use: 64% in IFR conditions*	Instrument approaches, radar separation	**119-150**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 9%	**Planned improvements (2013)**	Same		**130**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

Planned Improvements at PIT include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Revised wake vortex procedures, to increase arrival throughput on closely spaced parallel runways. However, this improvement does not affect the configurations modeled

Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

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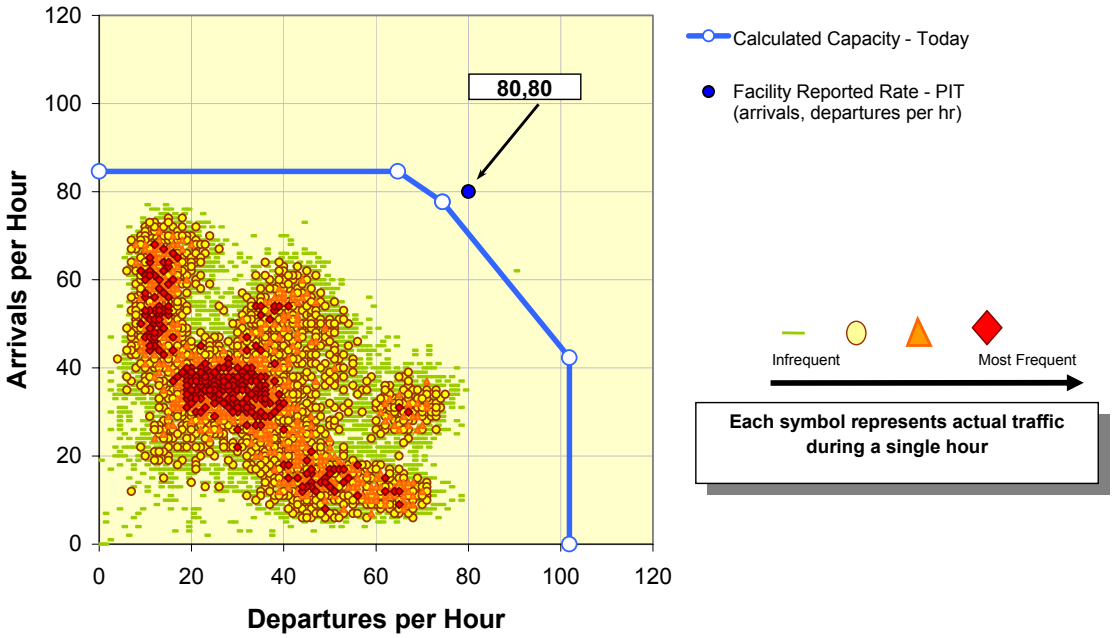
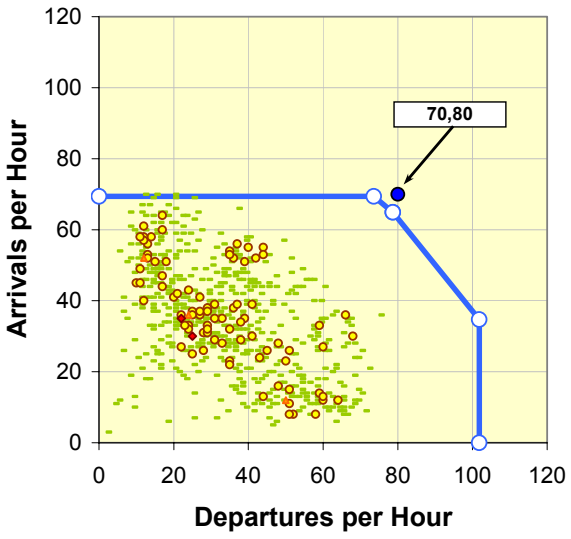
Calculated Capacity (Today) and Actual Throughput

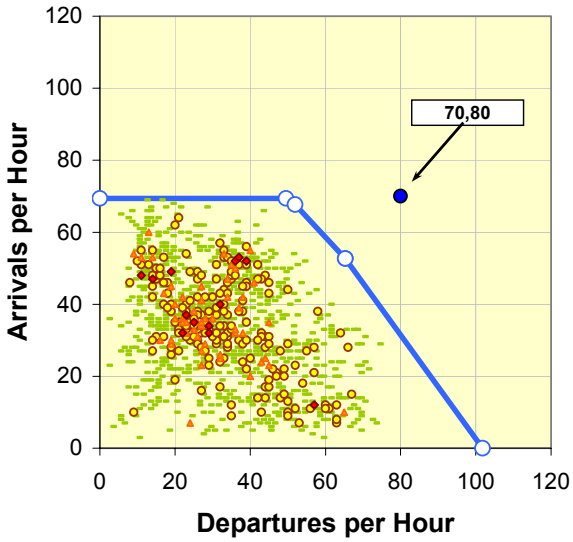
Optimum Rate



Marginal Rate

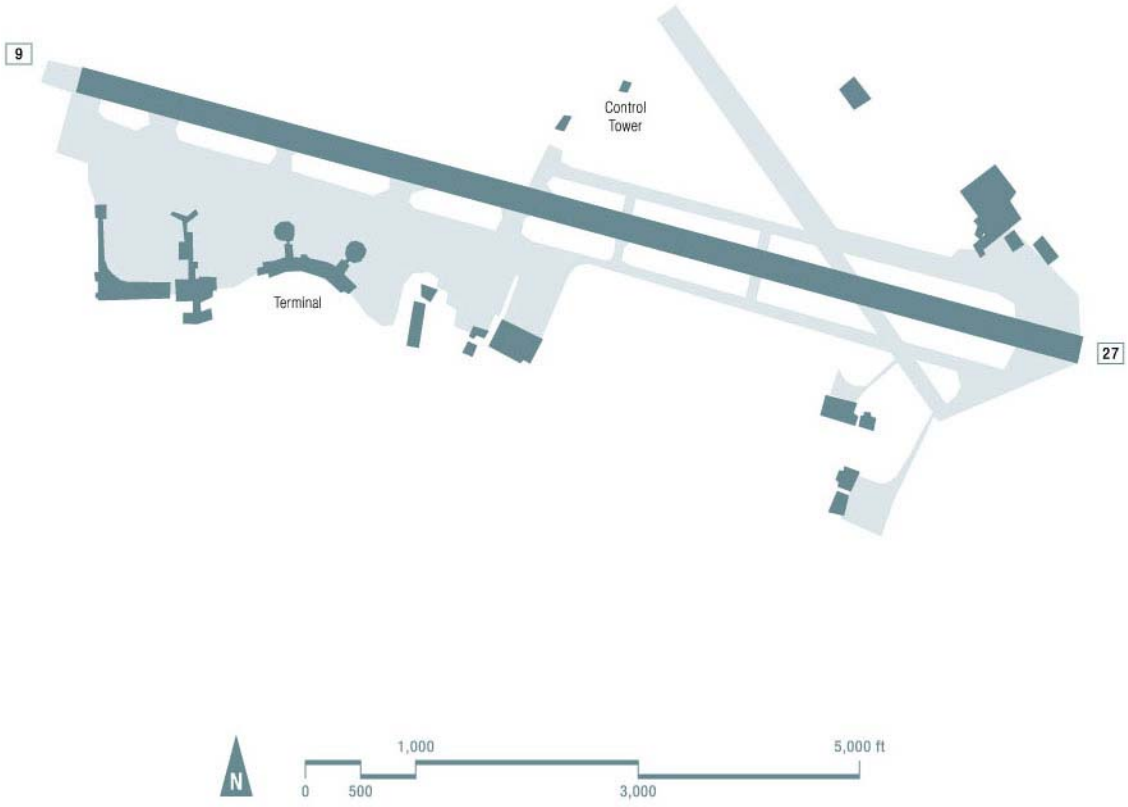


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at PIT.

SAN DIEGO – San Diego International–Lindbergh Field (SAN)



Benchmark Results

- The capacity benchmark for San Diego International-Lindbergh Field today is 56-58 flights per hour (arrivals and departures) in both Optimum and Marginal weather. These conditions occur during the vast majority of the year.
- The benchmark rate falls to 48-50 flights per hour in IFR conditions. However IFR conditions occur very rarely at SAN.
- The IFR benchmark rate assumes single direction operations, e.g., arrivals and departures on Runway 27. However, when the visibility is below 1¾ miles, SAN will operate with arrivals to Runway 9 but performance-limited departures will use Runway 27. Lower throughput can be expected during such opposite direction operations.
- These benchmark rates represent balanced operations, with equal numbers of arrivals and departures per hour. Greater total throughput may be possible during arrival or departure peaks. Lower throughput may occur when taxiway congestion prevents full utilization of the runway.
- Planned technological improvements at SAN would increase the arrival peak capacity by 30 percent in Marginal conditions; however it does not affect the benchmark rate, which reflects an equal number of arrivals and departures. The benefit in Marginal conditions assumes that all arrivals can use CEFR to achieve visual separations, thus allowing the airport to realize the Optimum rate arrival capacity in Marginal conditions.
- The following charts compare actual hourly traffic with the calculated capacity curves for SAN.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

SAN DIEGO – San Diego International-Lindbergh Field (SAN)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on 27 Departures on 27 *Frequency of Use: insufficient data; facility reported configuation*	Visual approaches, visual separation	**56-58**
Ceiling and visibility above minima for visual approaches (2000 ft ceiling and 3 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 64%	**Planned improvements (2013)**	Same		**58**
Marginal Rate	**Today**	Arrivals on 27 Departures on 27 *Frequency of Use: insufficient data; facility reported configuration*	Instrument approaches, visual separation	**56-58**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 32%	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**58**
IFR Rate	**Today**	Arrivals on 9 Departures on 9 *Frequency of Use: insufficient data; facility reported configuation*	Instrument approaches, radar separation	**48-50**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 5%	**Planned improvements (2013)**	Same		**50**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

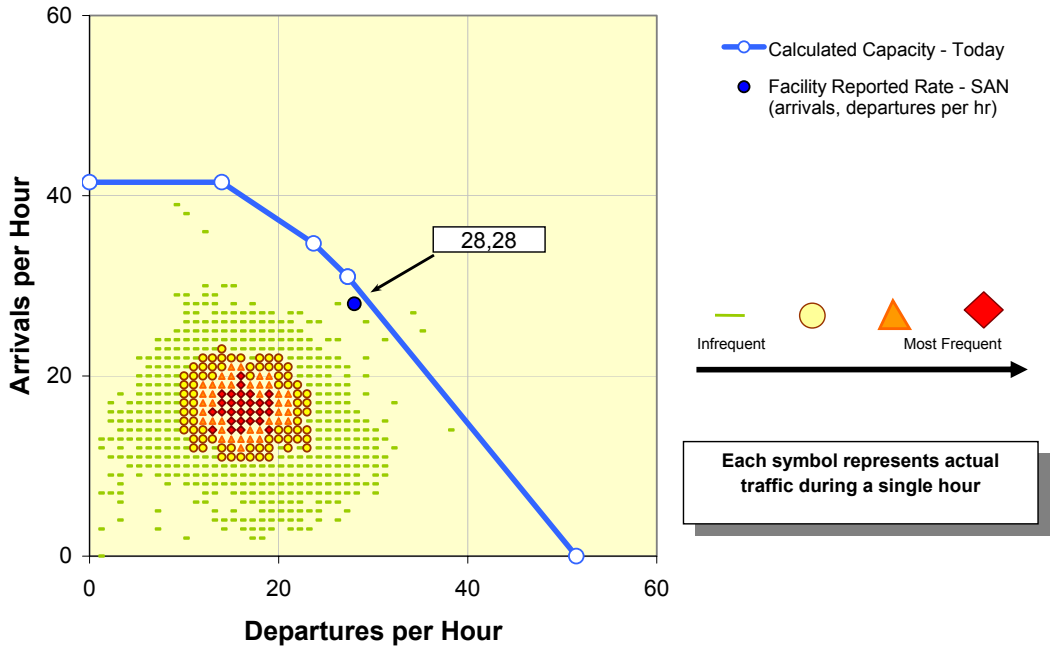
Planned Improvements at SAN include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.

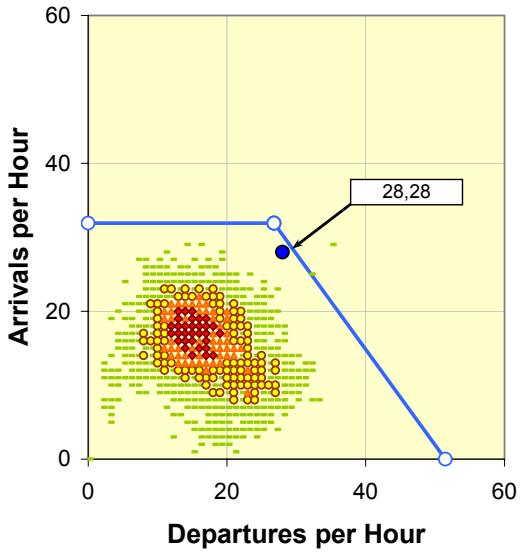
Additional information on this improvement may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

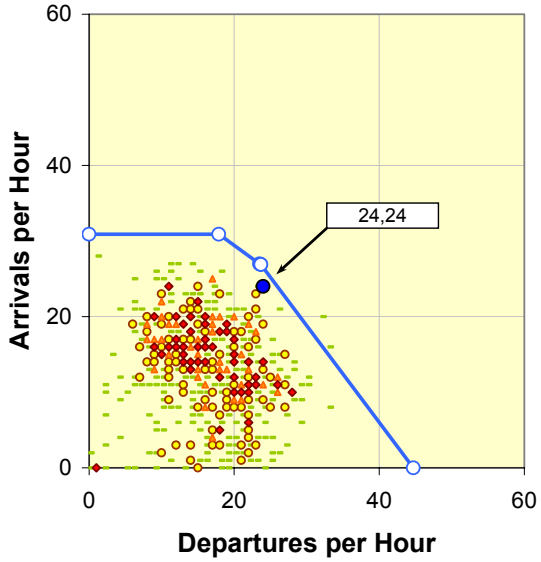
Optimum Rate



Marginal Rate

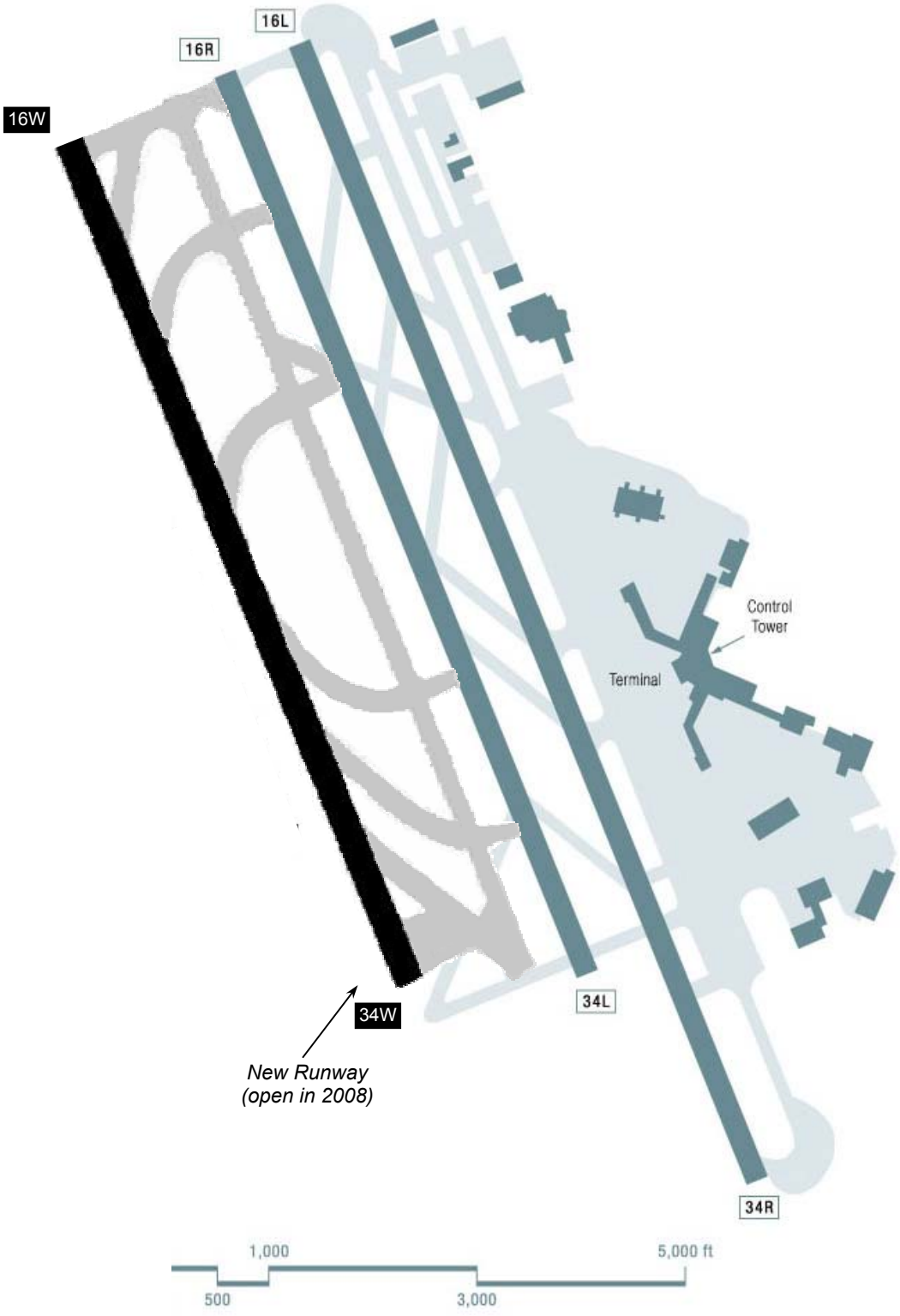


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at SAN.

SEATTLE – Seattle-Tacoma International (SEA)



Benchmark Results

- The capacity benchmark for Seattle-Tacoma International Airport today is 80-84 flights per hour (arrivals and departures) in Optimum weather, when visual approaches can be conducted.
- The benchmark decreases to 74-76 flights per hour in Marginal conditions, and to 57-60 flights per hour in IFR conditions, for the most commonly used runway configuration in these conditions. The IFR benchmark assumes low visibility, leading to more conservative procedures for crossing the departure runway and separating arrivals and departures.
- Throughput at SEA is affected by the need to taxi arrivals across the Runway 16L/34R (and in the future, across the current Runway 16R/34L as well). The effect of runway crossings on the benchmark capacity could only be approximated in the model used. Also, the benchmark analysis does not consider less-favorable runway configurations, operations in very low ceiling and visibility conditions, taxiway and gate congestion, or other non-runway constraints. Actual throughput may therefore vary from these benchmark rates.
- Note that if the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- A new runway, planned for completion in 2008, will allow dependent parallel instrument approaches in Marginal and IFR conditions. This new runway (herein referred to as Runway 16W/34W) will be used when required by traffic volume or weather conditions. The future benchmark values assume the new runway is in use; this may not be the most common configuration in the future at SEA. The projected increase in the benchmark rate at SEA occurs *only* if airspace design, ground infrastructure, and environmental constraints allow full use of dependent approaches at SEA.
- The new runway is expected to benefit operations during arrival peaks. The actual increase in arrival throughput will be affected by other operational factors at SEA, such as the amount of departure traffic and the need for arrivals to cross the departure runway.
- Planned technological improvements at SEA include CEFR, which will allow visual in-trail separations in Marginal conditions. Although the benchmark rates for the new runway plus these improvements is the same as the rates for just the new runway, CEFR is expected to provide additional arrival capacity in Marginal conditions.
- The following charts compare actual hourly traffic with the calculated capacity curves for SEA. Some hourly traffic points lie outside the capacity curves. There are many possible reasons why this may occur without affecting operational safety, including more efficient sequencing of aircraft, or above average pilot and controller performance. Also, ceiling and visibility in IFR conditions may have been better than was assumed for deriving the benchmark value.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

SEATTLE – Seattle-Tacoma International Airport (SEA)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 16R, (16L) Departures on 16L, (16R) *Frequency of Use: 57% in Optimum conditions*	Visual approaches, visual separation	**80-84**
Ceiling and visibility above minima for visual approaches (1700 ft ceiling and 3 mi visibility)	**New Runway (2008)**	Arrivals on Runways 16R, (16W-new) Departures on 16L, (16R)	Dual simultaneous visual approaches, visual separation	**102**
Occurrence: 64%	**Planned improvements (2013), including new runway**	Same		**102**
Marginal Rate	**Today**	Arrivals on Runway 16R Departures on 16L, (16R) *Frequency of Use: 89% in marginal conditions*	Instrument approaches, visual separation	**74-76**
Below visual approach minima but better than instrument conditions	**New Runway (2008)**	Arrivals on Runways 16L, (16W-new) Departures on 16R, (16L)	Dependent instrument approaches, visual separation	**100**
Occurrence: 29%	**Planned improvements (2013), including new runway**	Same	Dependent approaches, visual separation	**100**
IFR Rate	**Today**	Arrivals on Runway 16R Departures on 16L *Frequency of Use: 89% in IFR conditions*	Instrument approaches, radar separation	**57-60**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway (2008)**	Arrivals on Runways 16L, (16W-new) Departures on 16R	Dependent instrument approaches, radar separation	**72**
Occurrence: 7%	**Planned improvements (2013), including new runway**	Same		**72**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

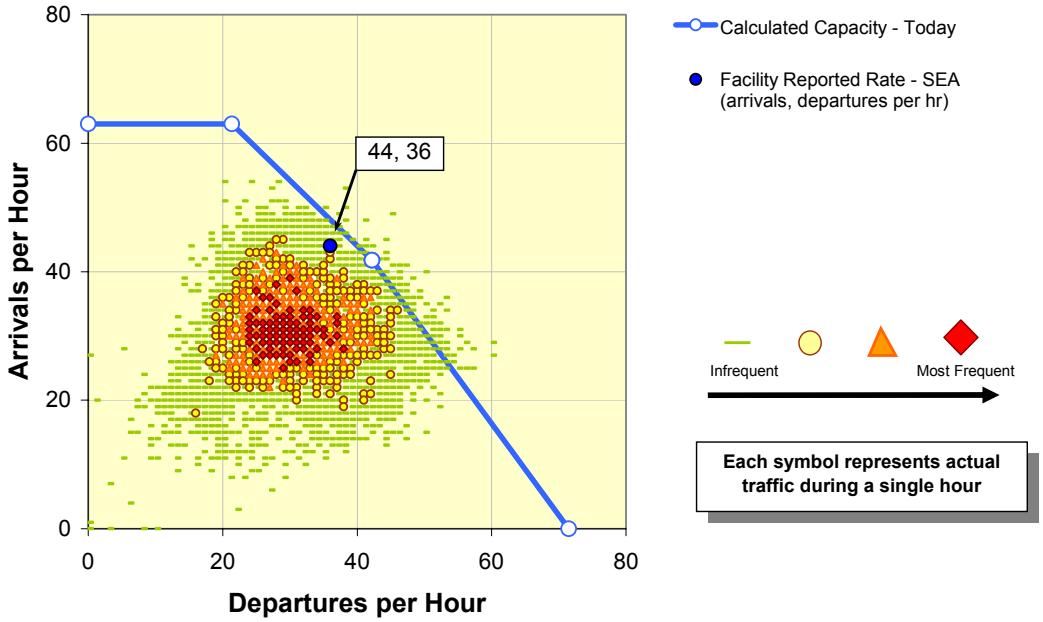
Planned Improvements at SEA include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Improved wake vortex procedures, for reduced separation between consecutive arrivals or consecutive departures on parallel runways less than 2500 feet apart.

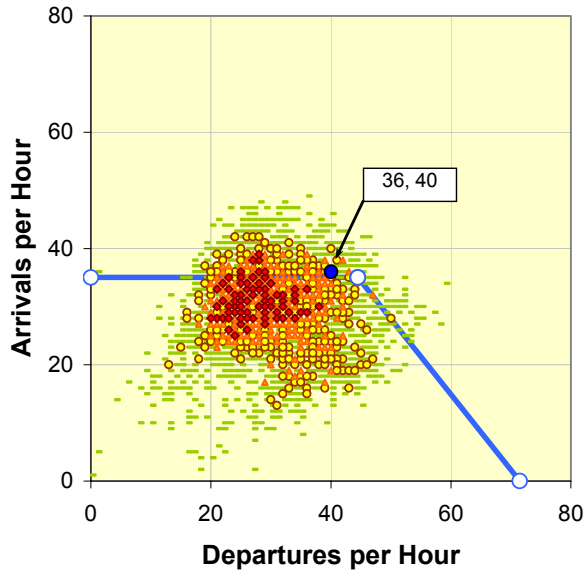
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

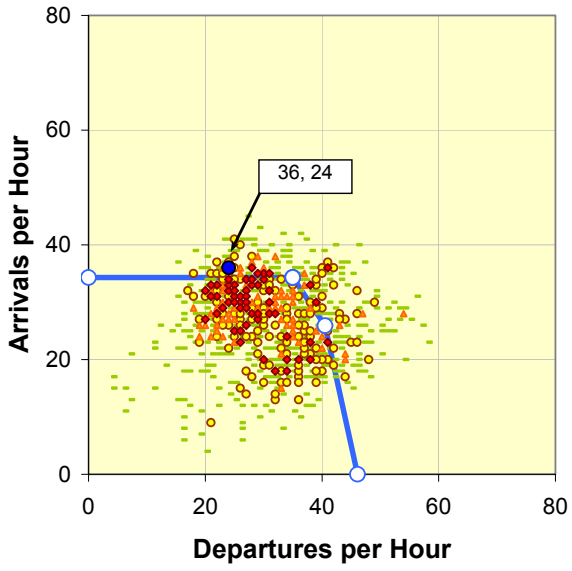
Optimum Rate



Marginal Rate

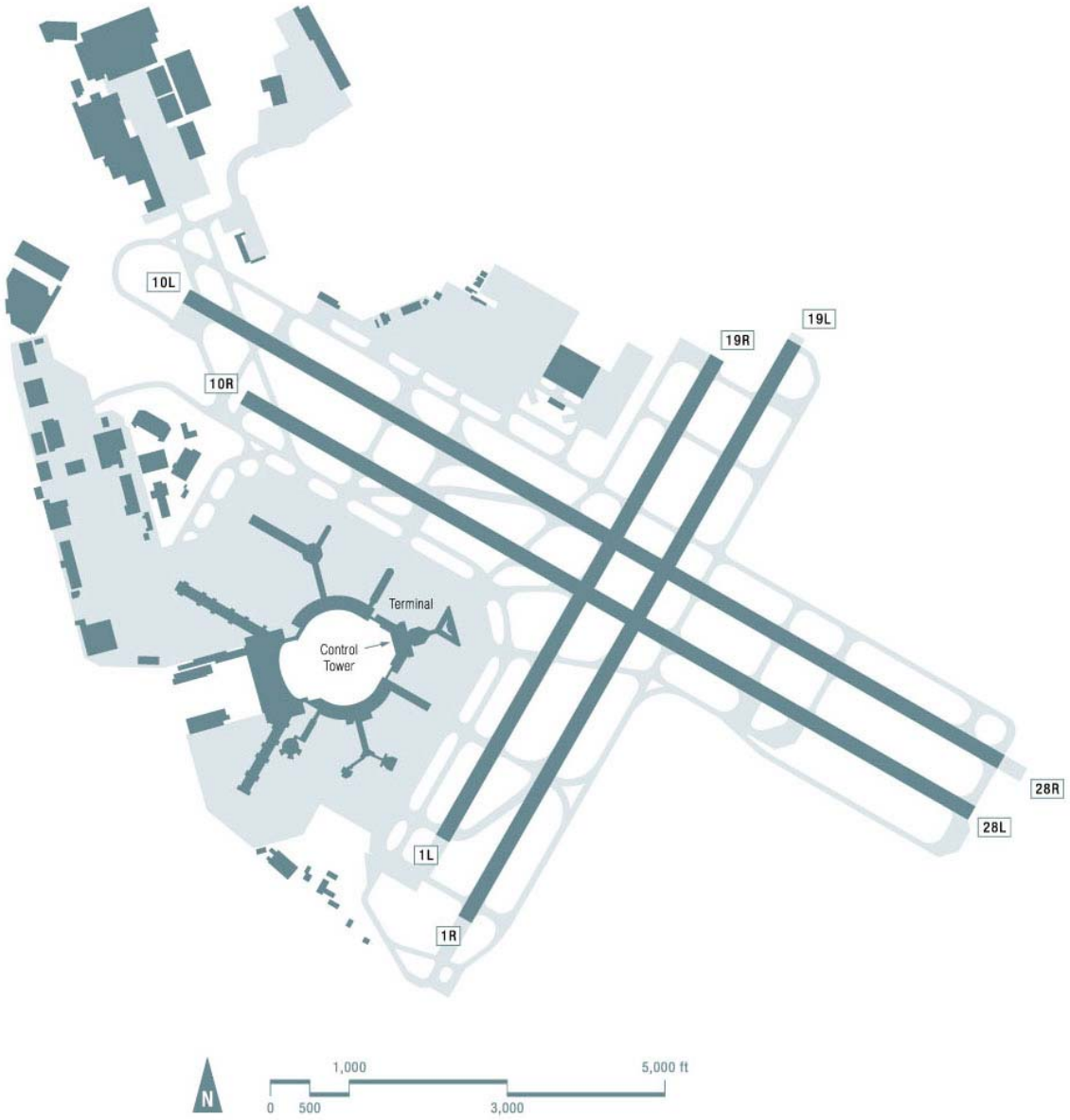


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at SEA.

SAN FRANCISCO– San Francisco International (SFO)



Benchmark Results

- The capacity benchmark for San Francisco International Airport today is 105-110 flights per hour (arrivals and departures) in Optimum weather.
- The benchmark rate decreases to 81-93 flights per hour in Marginal conditions and to 68-72 flights per hour in IFR conditions.
- Arrivals and departures at SFO use the closely spaced parallel runways. Such operations are sensitive to wake turbulence produced on the adjacent runway. The capacity at SFO is strongly influenced by the fleet mix at the airport, particularly the proportions of Small and Heavy aircraft.
- Note that these benchmark rates do not always represent balanced operations. Rather, there may be more departures than arrivals during the hour, or more arrivals than departures. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- Technology and procedural improvements are expected to increase the benchmark rate by up to 9 percent in Optimum conditions, 41 percent in Marginal conditions, and 1 percent in IFR conditions. The benefit in Optimum and IFR conditions derives from improved delivery accuracy that is assumed to result from advanced TMA and RNAV procedures.
- Another planned improvement, CEFR, will allow suitably equipped aircraft to maintain visual separations in Marginal conditions. Paired approaches to lower minima, based on SOIA or RPAT approach procedures, will also increase the Marginal benchmark rate at SFO.
- In the following charts, please note that a number of hourly traffic points fall outside the calculated capacity curves at SFO, especially in IFR conditions. There are many possible reasons why this may occur without affecting operational safety. For example, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures than were modeled.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

SAN FRANCISCO – San Francisco International Airport (SFO)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 28L, 28R Departures on 1L, 1R *Frequency of Use: 86% in optimum conditions*	Visual approaches, visual separation	**105-110**
Ceiling and visibility above minima for visual approaches (3500 ft ceiling and 8 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 74%	**Planned improvements (2013)**	Same		**114**
Marginal Rate	**Today**	Arrivals on Runways 28L, 28R Departures on 1L, 1R *Frequency of Use: 73% in optimum conditions*	Instrument approaches, visual separation	**81-93**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 20%	**Planned improvements (2013)**	Same	Paired approaches, visual separation	**114**
IFR Rate	**Today**	Arrivals on Runways 28L, 28R Departures on 1L, 1R *Frequency of Use: 77% in optimum conditions*	Instrument approaches, radar separation	**68-72**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 6%	**Planned improvements (2013)**	Same		**69**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

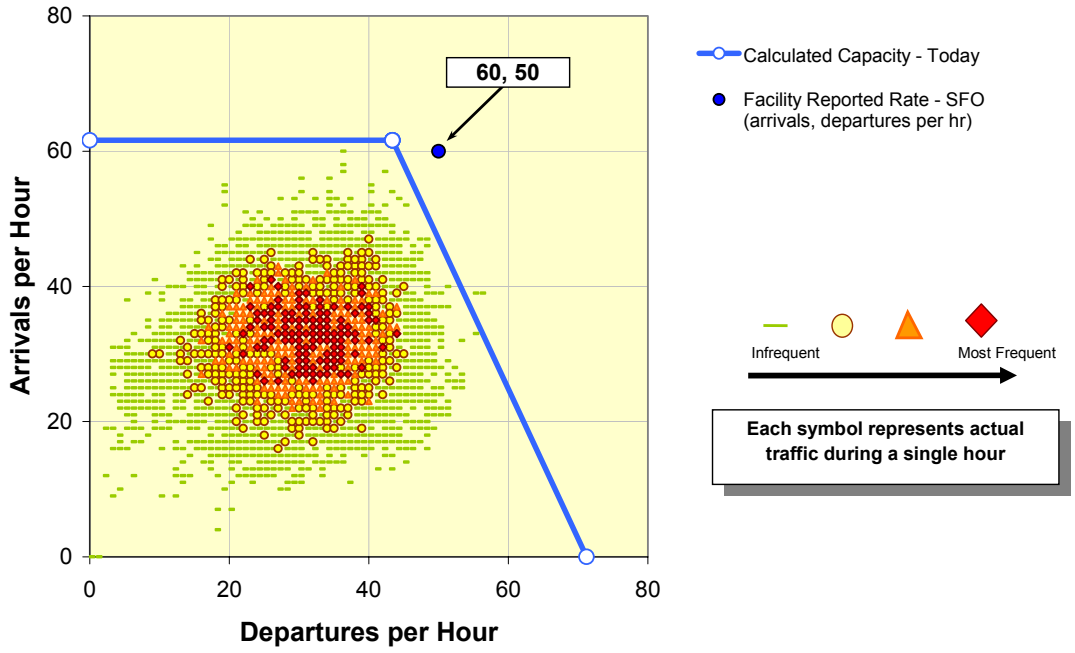
Planned Improvements at SFO include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- A Precision Runway Monitor (PRM) is also planned, which will allow Simultaneous Offset Instrument Approach (SOIA) operations on the parallel runways. SOIA operations will be conducted during periods of Optimum and Marginal conditions.
- Advanced TMA/RNAV, to improve delivery accuracy and help SFO consistently utilize available capacity.

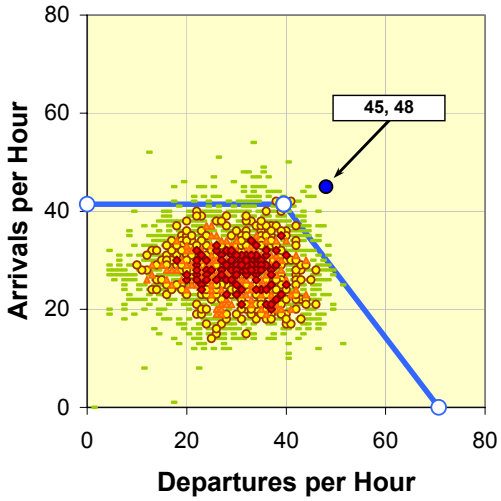
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

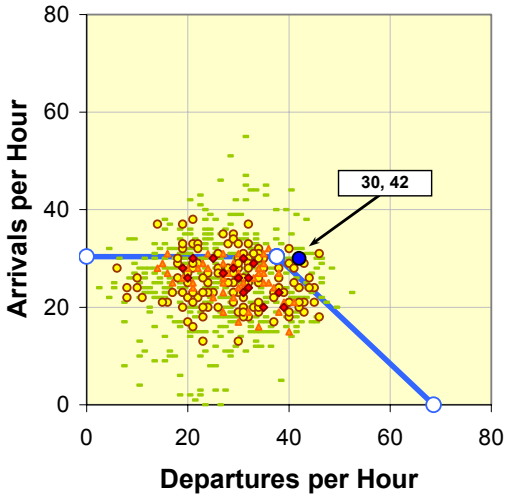
Optimum Rate



Marginal Rate

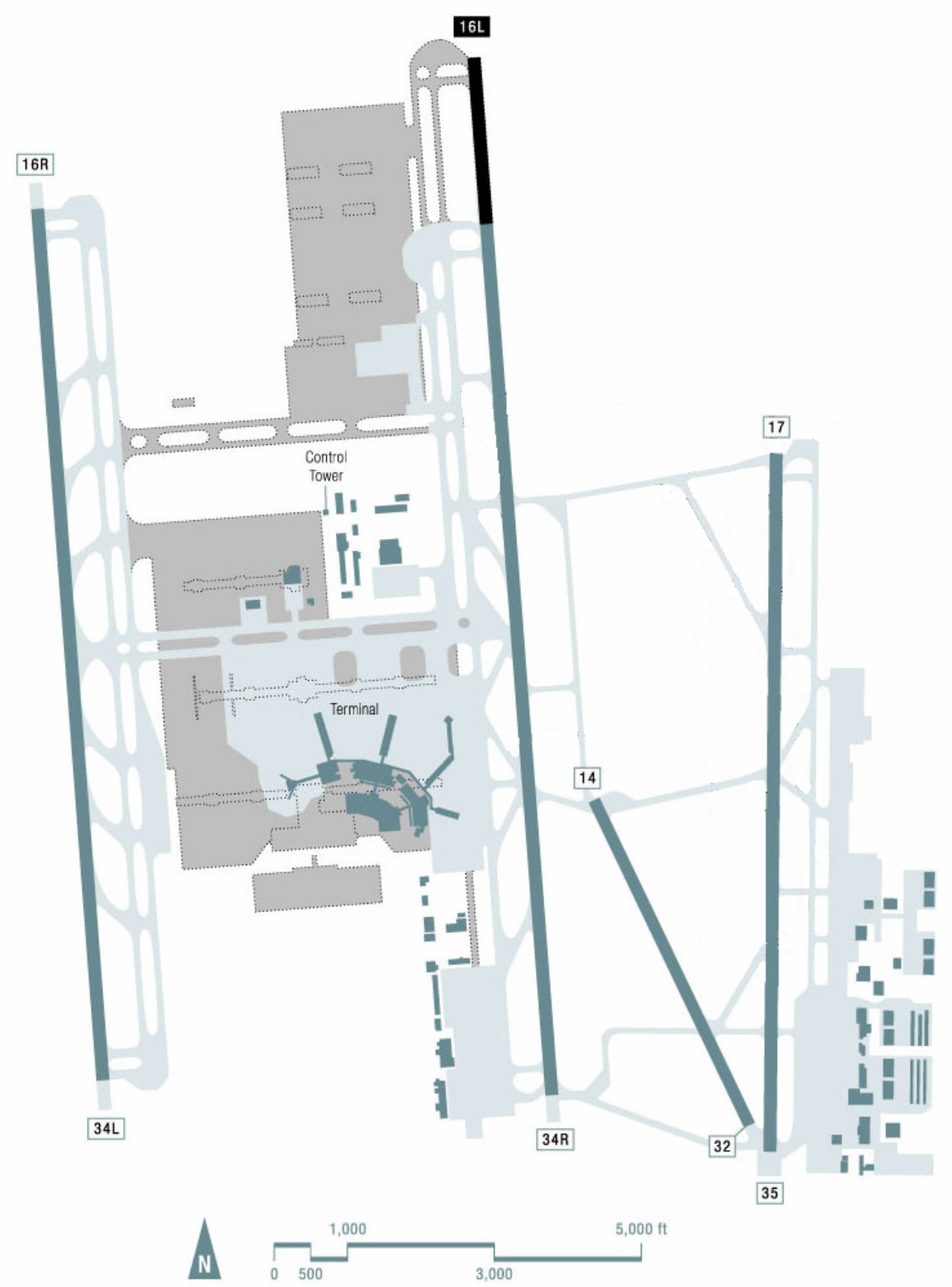


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at SFO.

SALT LAKE CITY – Salt Lake City International (SLC)



Benchmark Results

- The capacity benchmark for Salt Lake City International Airport today is 130-131 flights per hour (arrivals and departures) in Optimum weather.
- The benchmark rate decreases to 110-120 flights per hour in Marginal conditions and to 110-113 flights per hour in IFR conditions.
- Note these benchmark rates do not represent balanced operations. Rather, there are fewer departures than arrivals in all three scenarios. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- Planned technological improvements at SLC would increase the benchmark rate in Optimum and Marginal conditions. GPS and RNAV approaches to Runway 35 that parallel the approaches to Runways 34R/L would increase its usability for arrivals. Similarly, RNP departure routes might help to reduce current departure restrictions due to terrain. In Marginal conditions, CEFR will increase the benchmark rate by allowing suitably equipped aircraft to maintain visual separations.
- Runways 34R and 35 are considered a single runway in today's IFR conditions. There are no improvements planned that would increase the benchmark rate under IFR conditions.
- The following charts compare actual hourly traffic with the calculated capacity curves for SLC.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

SALT LAKE CITY – Salt Lake City International Airport (SLC)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 34L, 34R, 35 Departures on 34L, 34R, 35 *Frequency of Use: 50% in Optimum conditions*	Visual approaches, visual separation	**130-131**
Ceiling and visibility above minima for visual approaches (5300 ft ceiling and 3 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 85%	**Planned improvements (2013)**	Same		**160**
Marginal Rate	**Today**	Arrivals on Runways 34L, 34R, 35 Departures on 34L, 34R, 35 *Frequency of Use: 57% in Marginal conditions*	Instrument approaches, radar separation	**110-120**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 9%	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**160**
IFR Rate	**Today**	Arrivals on Runways 34L, 34R Departures on 34L, 34R, 35 *Frequency of Use: 69% in IFR conditions*	Instrument approaches, radar separation	**110-113**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 7%	**Planned improvements (2013)**	Same		**113**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

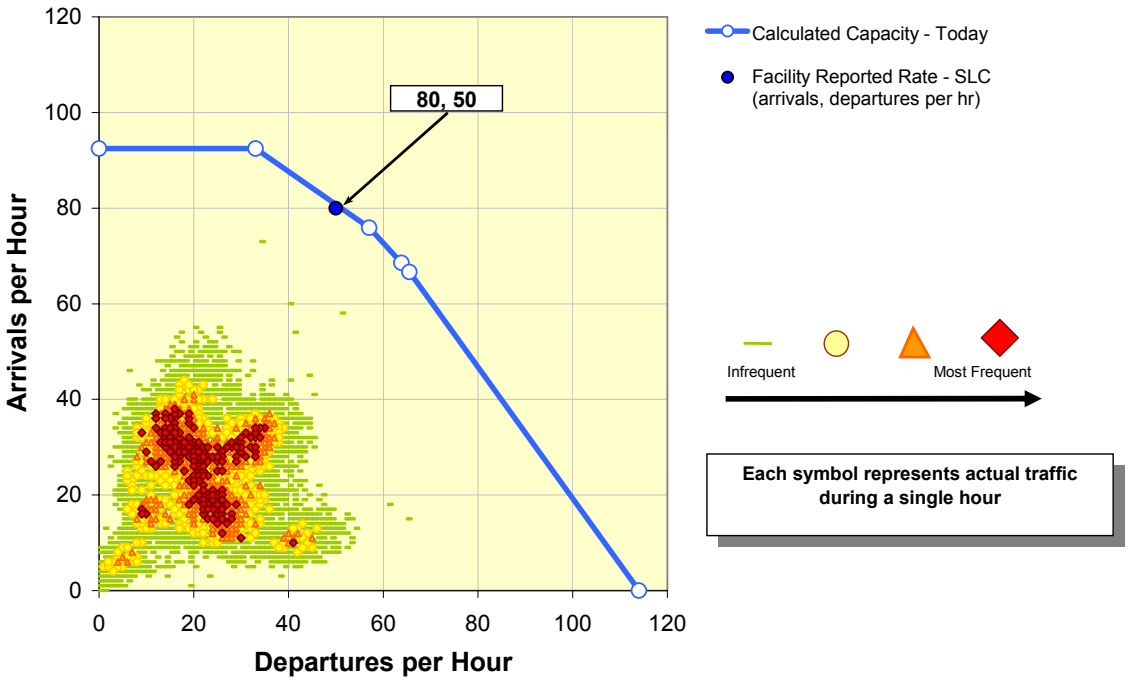
Planned Improvements at SLC include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Airspace redesign and relaxation of arrival and departure airspace restrictions.
- Increased use of runway 35 for arrivals with the aid of GPS and RNAV. RNAV departure guidance was assumed to allow additional departure routes, but research and analysis is needed to verify this.

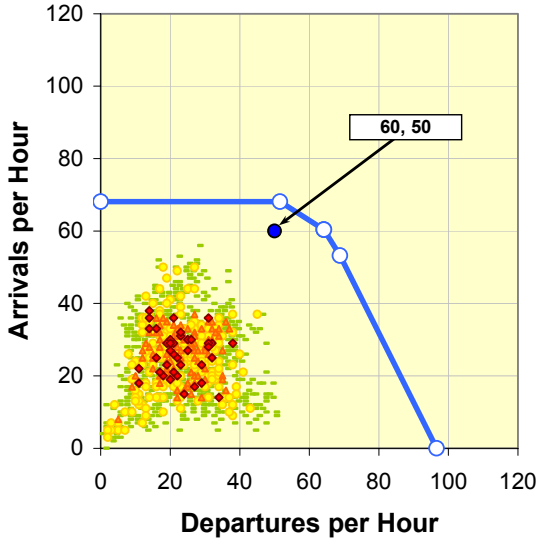
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

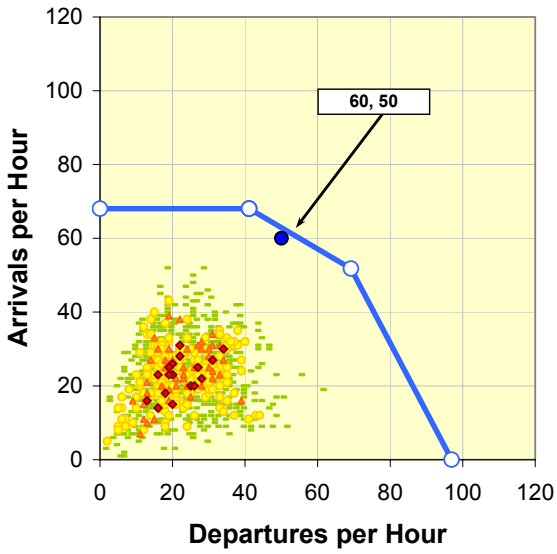
Optimum Rate



Marginal Rate

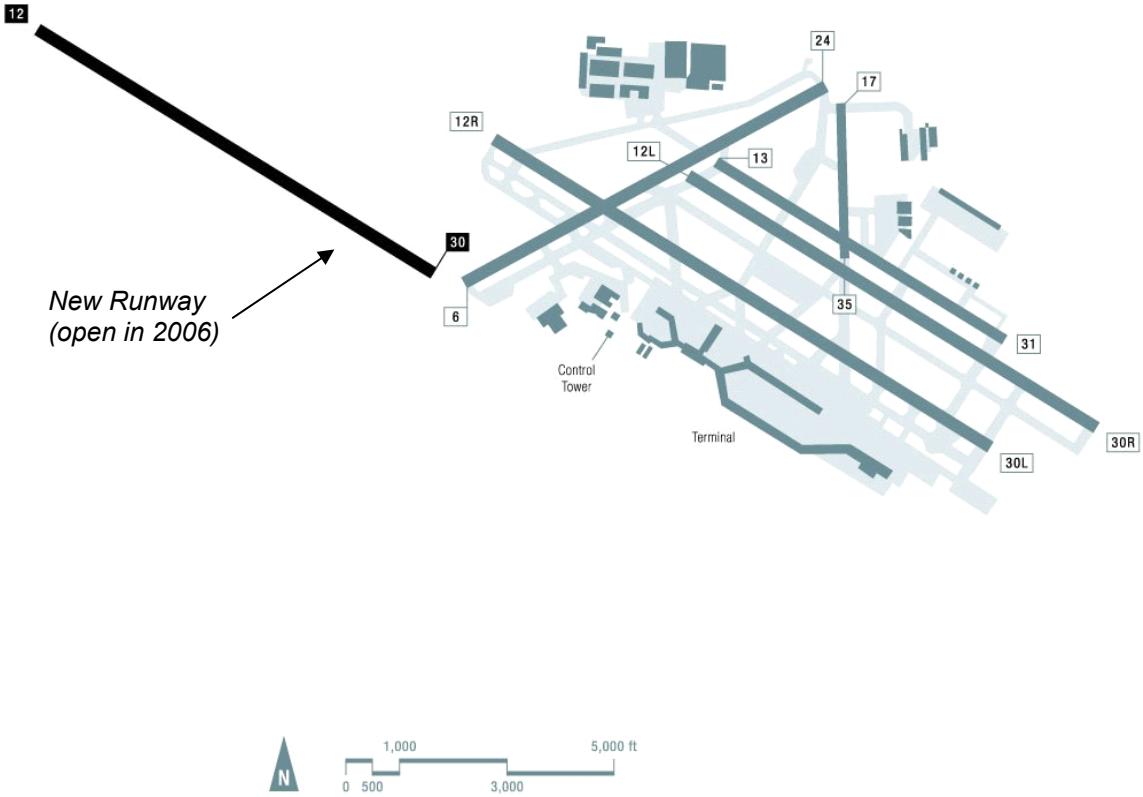


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were reviewed by ATC personnel at SLC.

ST. LOUIS – Lambert-St. Louis International (STL)



Benchmark Results

- The capacity benchmark for Lambert-St. Louis International Airport today is 104-113 flights per hour (arrivals and departures) in Optimum weather, when visual approaches or LDA (sidestep) approaches can be conducted.
- The benchmark rate decreases slightly to 91-96 flights per hour in Marginal conditions (below LDA minima but above 1000 ft ceiling and 3 mi visibility), and to 64-70 flights per hour in IFR conditions (below 1000-3). These benchmarks were determined for runway configurations that were determined by the FAA to be typical for these conditions, although they are not the most frequently used configurations. Data on the frequency with which these configurations are used was not available.
- Other runway configurations may provide greater capacity. On the other hand, these benchmarks do not consider airspace restrictions or other non-runway constraints. More detailed simulations that account for such constraints show lower rates at STL.
- Note that these benchmark rates represent balanced operations. Greater throughput may be possible during arrival or departure peaks.
- A new runway, planned for completion in 2006, will be spaced about 4000 feet from Runway 12L/30R. Together with a PRM system (which is already installed at STL), this runway will potentially allow simultaneous instrument approaches in Marginal and IFR conditions, increasing the benchmark rate by as much as 60 percent. The projected increase in the benchmark rate can occur *only* if ground infrastructure, environmental constraints, staffing, pilot acceptance, and equipment requirements allow simultaneous approaches at STL. The increase in actual operations may be less if airspace restrictions prevent full use of the new runway.
- Planned technological improvements at STL include CEFR, which will allow visual separations in Marginal conditions. CEFR is expected to increase the benchmark rate for Marginal conditions by as much as 18 percentage points.
- Other planned technological improvements at STL would increase the benchmark rate by 5-17 additional percentage points. This additional benefit derives mainly from improved delivery accuracy that is assumed to result from advanced TMA and RNAV procedures. CEFR, another planned improvement, will reduce the in-trail separation between arrivals in Marginal conditions.
- The following charts compare actual hourly traffic with the calculated capacity curves for STL. Some hourly traffic points lie outside the capacity curves, especially for the IFR scenario. There are many possible reasons why this may occur without affecting operational safety, including use of a higher-capacity runway configuration than the one modeled. Also, actual weather conditions during the hour may have been better than the hourly readings in the database, allowing more efficient ATC procedures.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

ST. LOUIS – Lambert-St. Louis International Airport (STL)

Weather	*Scenario*	*Configuration*	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 30L, 30R Departures on 30L, 30R *Frequency of Use: 59% in Optimum conditions*	Dual simultaneous visual or LDA approaches, visual separation	**104-113**
Ceiling and visibility above minima for visual approaches (4000 ft ceiling and 7 mi visibility) and LDA approaches (1200 ft and 4 mi)	**New Runway (2006)**	Arrivals on Runways 30 (new), 30R Departures on 30 (new), 30L		**151**
Occurrence: 76%	**Planned improvements (2013), including new runway**	Same		**159**
Marginal Rate	**Today**	Arrivals on Runways 30R, 24 Departures on 30L *Frequency of Use: see text*	Independent converging instrument approaches, radar and visual separation	**91-96**
Below LDA approach minima but better than instrument conditions	**New Runway (2006)**	Arrivals on Runways 30 (new), 30R Departures on 30 (new), 30L	Simultaneous instrument approaches, radar and visual separation	**140**
Occurrence: 17%	**Planned improvements (2013), including new runway**	Same	Dual simultaneous approaches, visual separation	**155**
IFR Rate	**Today**	Arrivals on Runways 30R Departures on 30L *Frequency of Use: see text*	Instrument approaches, radar separation	**64-70**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway (2006)**	Arrivals on Runways 30 (new), 30R Departures on 30 (new), 30R	Simultaneous instrument approaches, radar separation	**114**
Occurrence: 7%	**Planned improvements (2013), including new runway**	Same		**118**

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

Full operational use of the new parallel runway will require dual monitor positions and staffing to support simultaneous instrument approaches, pilot acceptance of procedures for closely spaced parallel approaches, and an airspace redesign to deliver aircraft efficiently to the approaches.

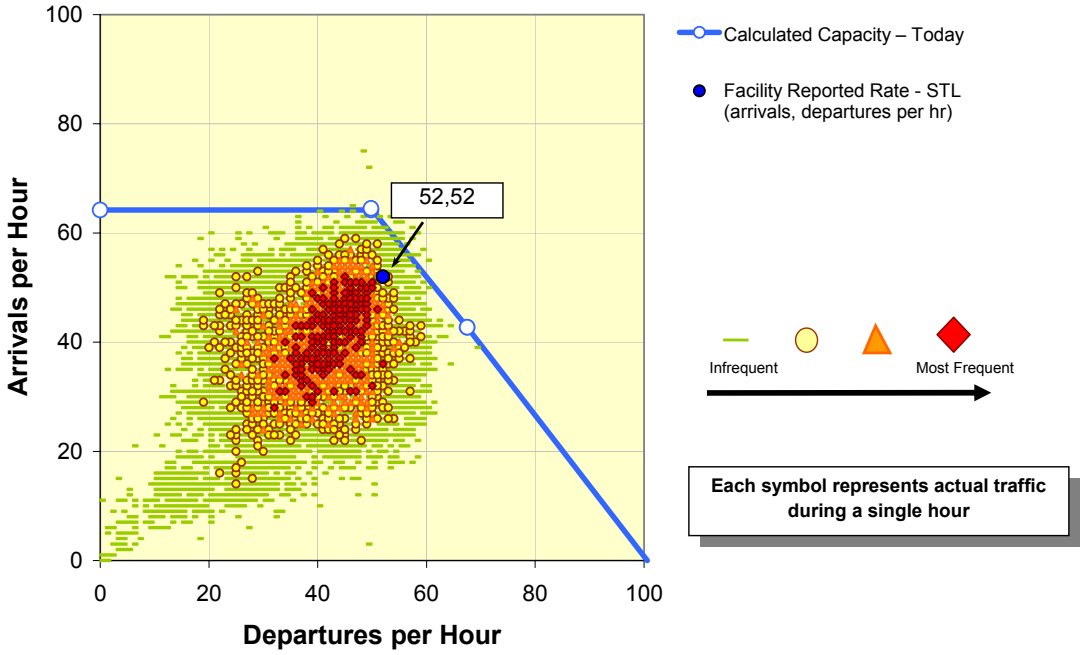
Planned Improvements at STL include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.
- Advanced TMA/RNAV, to improve delivery accuracy and help STL consistently utilize available capacity.

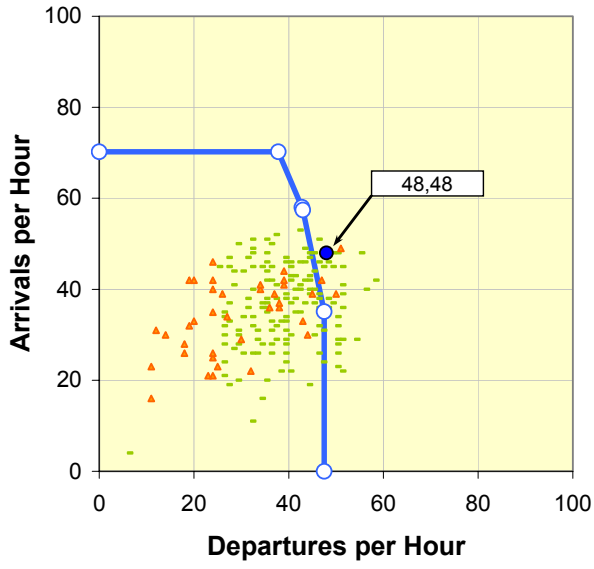
Additional information on these improvements may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

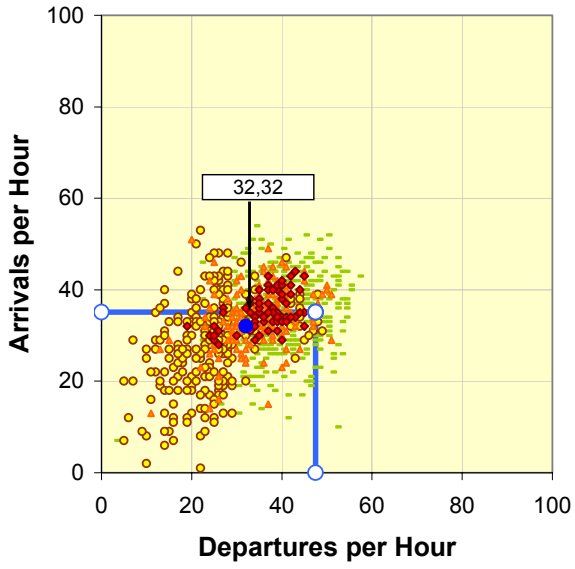
Optimum Rate



Marginal Rate

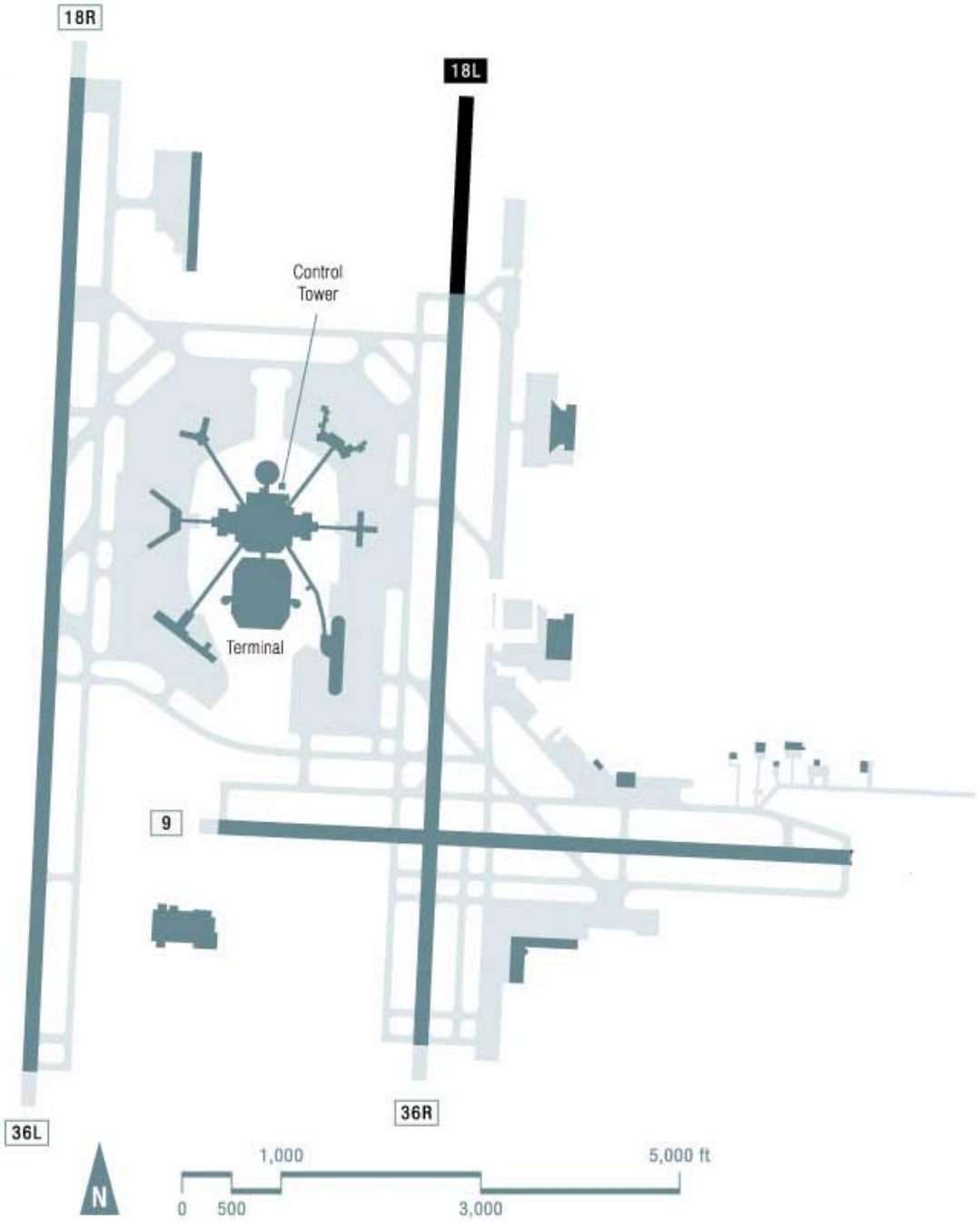


IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at STL.

TAMPA – Tampa International (TPA)



Benchmark Results

- The capacity benchmark for Tampa International Airport today is 102-105 flights per hour (arrivals and departures) in Optimum weather.
- The benchmark rate decreases in Marginal conditions to 90-95 flights per hour, and in IFR conditions to 74-75 flights per hour, for the selected runway configuration in these conditions. Throughput may be less when ceiling and visibility are low, demand is less than capacity, or non-runway constraints (such as airspace restrictions) limit operations.
- At TPA, Runway 36R is generally not used for turbojet arrivals, and Runway 18L is not used for turbojet departures, for noise abatement. In addition, turbojet departures fly runway heading until leaving 3000 feet, to limit noise exposure on the ground. The calculation of future benchmark rates assumed that these procedures would continue.
- Note that these benchmark rates do not represent balanced operations. Rather, the benchmarks include more arrivals than departures in all weather scenarios. Greater throughput may be possible during departure peaks. If the facility reported rates are significantly unbalanced (i.e., unequal numbers of arrivals and departures), the benchmark rates will be unbalanced as well. The facility reported rates reflect current operations at the airport during a busy hour, but such unbalanced rates cannot be sustained for extended periods.
- Planned technological improvements at TPA include CEFR, which would increase the benchmark rate by as much as 7 percent in Marginal conditions by allowing suitable equipped aircraft to maintain visual separations. The benefit of CEFR would be greater during periods of high arrival demand.
- The following charts compare actual hourly traffic with the calculated capacity curves for TPA.

These values were calculated for the Capacity Benchmarking task and should not be used for other purposes, particularly if more detailed analyses have been performed for the airport or for the individual programs.

The list of Planned Improvements and their expected effects on capacity does not imply FAA commitment to or approval of any item on the list.

TAMPA – Tampa International Airport (TPA)

Weather	*Scenario*	*Configuration**	*Procedures*	*Benchmark Rate (per hour)*
Optimum Rate	**Today**	Arrivals on Runways 18L, 18R Departures on 18R (18L) *Frequency of Use: 46% in Optimum conditions*	Visual approaches, visual separation	**102-105**
Ceiling and visibility above minima for visual approaches (2100 ft ceiling and 3 mi visibility)	**New Runway**	N/A		**N/A**
Occurrence: 93%	**Planned improvements (2013)**	Same		**102**
Marginal Rate	**Today**	Arrivals on Runways 18L, 18R Departures on 18R (18L) *Frequency of Use: 42% in Marginal conditions*	Instrument approaches, visual separation	**90-95**
Below visual approach minima but better than instrument conditions	**New Runway**	N/A		**N/A**
Occurrence: 3%	**Planned improvements (2013)**	Same	Visual approaches, visual separation	**102**
IFR Rate	**Today**	Arrivals on Runways 18L, 18R Departures on 18R (18L) *Frequency of Use: 38% in IFR conditions*	Instrument approaches, radar separation	**74-75**
Instrument conditions (ceiling < 1000 ft or visibility < 3.0 miles)	**New Runway**	N/A		**N/A**
Occurrence: 4%	**Planned improvements (2013)**	Same		**74**

* Note that this is not the most commonly used configuration, but instead is a typical configuration that produces the observed throughputs.

NOTE: Data on frequency of occurrence of weather and runway configuration usage is based on FAA ASPM data for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time.

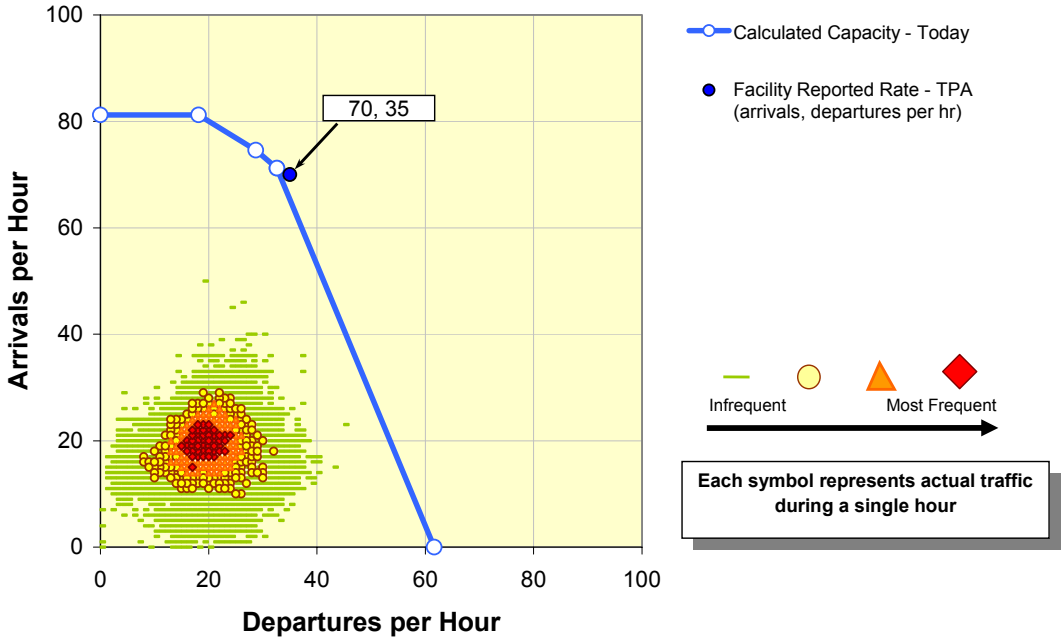
Planned Improvements at TPA include:

- CEFR, for reduced in-trail separations between arrivals in Marginal conditions.

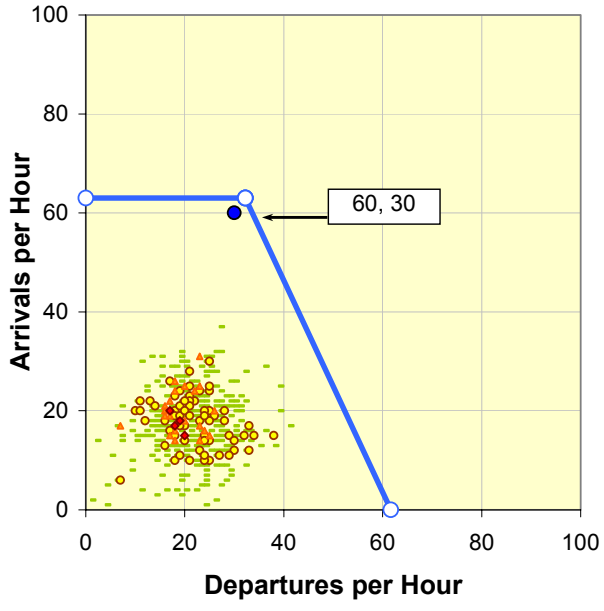
Additional information on this improvement may be found in the Introduction and Overview of this report, under “Assumptions.”

Calculated Capacity (Today) and Actual Throughput

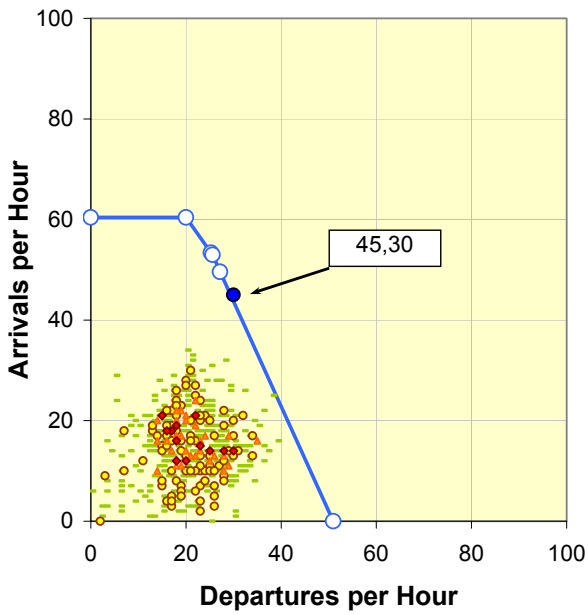
Optimum Rate



Marginal Rate



IFR Rate



Hourly traffic data was obtained from the FAA ASPM database for January 2000 to July 2002 (excluding 11-14 September 2001), 7 AM to 10 PM local time. Facility reported rates were provided by ATC personnel at TPA.

Appendix

Benchmark Values and Airline Schedules

Introduction

Airport delay can be expected when too many aircraft want to use the same runway or airspace at the same time. At the major airports, scheduled traffic by air carriers and commuters is the main component of total operations, and thus is an important factor in airport delays. On the following pages, air carrier schedule data from the Official Airline Guide (OAG) is compared to the capacity benchmarks at ten of the busiest and most delayed airports in the country.

Airline Schedule-Benchmark Charts

Charts comparing schedule and benchmark data were generated for ten major airports:

- Chicago O'Hare International Airport (ORD)
- Dallas/Fort Worth International Airport (DFW)
- Fort Lauderdale-Hollywood International Airport (FLL)
- Hartsfield-Jackson Atlanta International Airport (ATL)
- Houston George Bush Intercontinental Airport (IAH)
- Minneapolis-St. Paul International Airport (MSP)
- New York LaGuardia Airport (LGA)
- Newark Liberty International Airport (EWR)
- Philadelphia International Airport (PHL)
- Washington Dulles International Airport (IAD)

Each chart depicts scheduled traffic (arrivals, departures, or total operations) by 15-minute periods from 7 AM until 10 PM local time. The schedules for each day of the week, Sunday through Saturday, were averaged over three months for both a peak and an off-peak season at each airport. Although traffic on weekdays is slightly higher than traffic on the weekends, using the schedule for all seven days allowed us to include the busy Sunday evening period.

Each chart also shows the Current Optimum and IFR benchmark values, adjusted for the 15-minute period, as well as the *average called rates* during the given period, by 15-minute period.

The arrival and departure benchmark rates indicate the number of flights that the airport could be expected to handle during an hour, given a typical operational configuration. The actual number of operations (or *throughput*) during that period is a result of many factors such as traffic schedules, weather, and the runway configuration in use. En route airspace congestion and delays at other airports may also affect throughput, especially if flow management measures such as ground delay programs are implemented. The ATC facility at the airport constantly advises the Air Traffic Control System Command Center (ATCSCC) on the number of arrivals and departures that they expect to be able to handle based on conditions at the airport, taking into account the weather and runway configuration. These airport *called rates*, the Airport Arrival Rate (AAR) and the Airport Departure Rate (ADR), reflect actual conditions at the airport during the given time period. The called rate may be as high as the Optimum rate or lower than the IFR rate; the average usually lies in between, depending on the weather and runway configurations in use during the charted period.

A sample chart, for arrivals at EWR during the period of May-July 2004, is presented in Figure A-1.

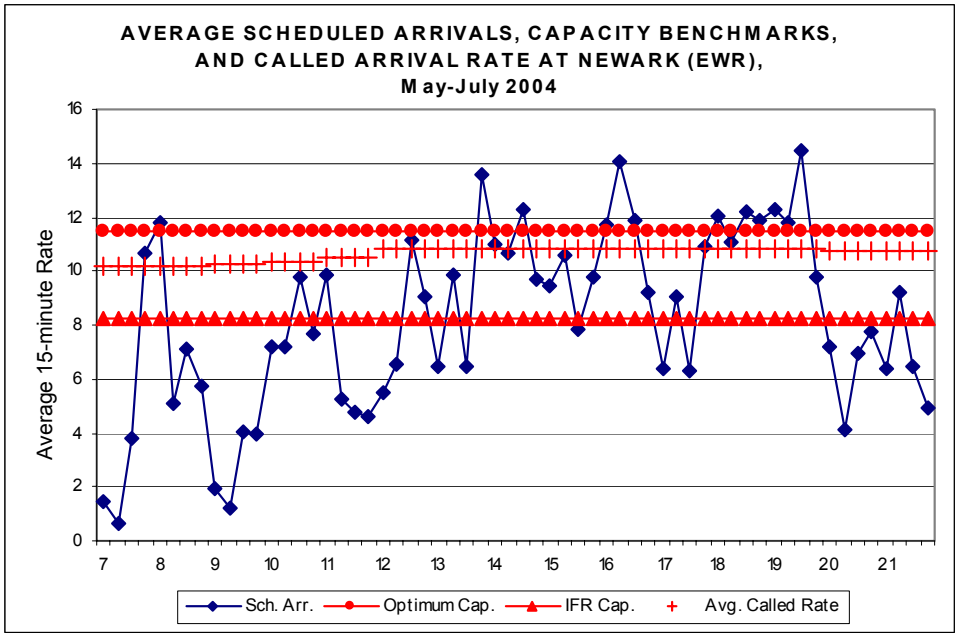


Figure A-1 – Schedule vs. Benchmarks at EWR

Scheduled and Non-scheduled Traffic

Scheduled carrier operations constitute a significant part, but not all, of an airport's traffic. Non-scheduled traffic includes air taxi flights, military operations, general aviation (including charter flights), and some cargo operations. Scheduled flights, including air carriers and commuter carriers, accounted for approximately 78-98 percent of the total traffic at these ten airports during 2002 and 2003, according to the FAA Terminal Area Forecast[1] (see Table A-1).

Table A-1
Selected Airports and Percentage of Scheduled Operations

Airport	Airport Name	Air Carrier, Commuter and Air Taxi Operations
ATL	Hartsfield-Jackson Atlanta International Airport	98%
DFW	Dallas/Fort Worth International Airport	97%
EWR	Newark Liberty International Airport	97%
FLL	Fort Lauderdale-Hollywood International Airport	78%
IAD	Washington Dulles International Airport	79%
IAH	Houston George Bush Intercontinental Airport	95%
LGA	New York LaGuardia Airport	97%
MSP	Minneapolis-St. Paul International Airport	89%
ORD	Chicago O'Hare International Airport	97%
PHL	Philadelphia International Airport	86%

[1] The Terminal Area Forecast provides data on Commuter (scheduled) and Air Taxi (unscheduled) operations combined. The percentages shown in Table A-1 include some unscheduled Air Taxi operations, and therefore overstate the actual percentage of scheduled operations. However, the number of Air Taxi operations is generally small (estimated to be 2-5 percent of total traffic).

The following charts depict only airline and commuter schedules. The effect of the non-scheduled traffic is uncertain. Some of the non-scheduled flights may use a separate runway, as at FLL, or they may try to avoid operating during the busy periods for the air carriers. However, non-scheduled flights might contribute to delay during the busy times of the day at some airports, even though air carrier operations are the main component of operations at these ten airports

Arrival and Departure Benchmarks

The overall benchmark rate for total arrivals and departures at an airport generally assumes a balanced operation, with equal numbers of arrivals and departures. In the long run, the number of aircraft that land at an airport will equal the number of aircraft that take off. But from hour to hour, the number of scheduled arrivals may be much more or much less than the number of scheduled departures.

Some airports will change their operations to handle such unbalanced demand, and this affects their arrival and departure benchmark rates. For example, IAD can handle 90 arrivals per hour ***or*** 75 departures per hour – but not both in the same hour. The benchmark for IAD is 135 operations per hour in Optimum weather conditions. It is possible to schedule fewer than 135 total operations in a single hour, yet still exceed the departure benchmark rate of 75. Conversely, it is possible to schedule more than 135 operations per hour without exceeding either the arrival or the departure benchmark rate.

To recognize such cases, three charts were prepared for each airport:

- Scheduled arrivals versus the arrival benchmark rate
- Scheduled departures versus the departure benchmark rate
- Scheduled total traffic, arrivals and departures, versus the benchmark rate for total traffic.

This allows us to identify whether the scheduled traffic exceeds the arrival capacity of the airport, its departure capacity, or its combined capacity.

Schedule, Capacity, and Delay

In the following charts, the airline schedule lines exhibit several peaks where the number of scheduled operations exceeds the Optimum benchmark value, and even more instances where the schedule exceeds the IFR benchmark. If the scheduled operations are greater than the benchmark value for a given time period, some of those scheduled operations may be delayed until the next time period. Airline “overscheduling” – scheduling more flights than the airport can be expected to handle during that time period – is thus one factor in airport delay.

A small amount of overscheduling is not necessarily undesirable, and may actually enhance the efficiency of the airport. Flights do not always operate on schedule: they may arrive early due to favorable winds, or they may leave the gate late due to mechanical problems. Some overscheduling during busy periods helps to ensure that there is always an aircraft waiting to use the runway despite such schedule deviations. An airport runway is a limited resource; if it goes unused because no aircraft is available to use it, the opportunity is lost and cannot be reclaimed.

The airlines may also have business reasons for overscheduling. Each airline would like to maximize their market share, and to do so they will schedule flights during the preferred morning and evening travel times. An airline with a hub operation at the airport may schedule a bank of arrivals, followed by a bank of departures. The airline may overschedule these banks knowing that some flights will arrive early and some will be late, with the net effect of having continuous demand at the runway end.

The amount of delay caused by overscheduling depends on many factors, but one of the main factors is the availability of compensating “underscheduled” periods during the day. If a schedule peak is followed by an equivalent or greater “valley”, then the scheduled traffic can be handled in the next time period and delays will be short. If the peak extends over several time periods,

however, it will take longer to eliminate the backlog of waiting flights, and delays will increase accordingly.

Other Factors Affecting Actual Operations and Delay

Delay occurs when there is more demand than the airport can accommodate. Persistent, severe levels of delay are primarily due to excess levels of traffic, which at these airports is mainly scheduled airline traffic.

The following charts of scheduled airline traffic versus the benchmarks are intended to illustrate the general situation at each airport. The actual delay at each airport, however, is governed by many factors, some of which do not appear on these charts. These factors include:

Actual Flight Times: Airline schedules are generally based on block times between airports, and may include an additional time margin to compensate for congestion or other factors. Actual arrival times may therefore be earlier or later than the scheduled time on a given day due to non-airport factors. The scheduled arrival and departure times may not therefore represent the actual pattern of operations at the airport.

Schedule Distribution: The delay experienced by flights in a given time period is also affected by the distribution of flights within that time period. Clustering of flights within the time period will lead to more delay than if the flights were evenly distributed. For example, suppose that a runway can accommodate one departure each minute. If the schedule provides one departure per minute, delays will be minimal. However, if 15 departures leave the gate at the same time, one will be delayed by a minute, another by two minutes, and so forth, with the last departure delayed by 14 minutes.

Arrival/Departure Priority: At many airports, more arrivals can be handled if fewer departures are scheduled for that time period, and vice versa. Such airports (like IAD) may use different runway configurations for an arrival peak versus a departure peak, or arrival separation may be increased to allow one or more departures between each arrival pair. The benchmark rate, however, reflects just a single mode of operation, usually balanced operations. The benchmark rate may therefore underestimate the ability of the airport to accommodate schedule peaks.

Weather: One weather effect is apparent in the following charts: the IFR benchmark is lower than the Optimum benchmark. As ceiling and visibility decrease, the number of operations per hour that the airport can handle also decreases. Wind speed and direction can also affect airport capacity by forcing the use of less efficient runway configurations. Even with the highest ceilings and visibilities, an airport may not be able to achieve the Optimum benchmark rate if it is forced to operate in a different runway configuration.

Environmental Constraints: The runway configuration in use may also be affected by local environmental restrictions, such as a requirement to “rotate” runway usage over the day. Such restrictions usually require the use of runway configurations that are less efficient but which reduce noise exposure in sensitive areas.

Non-Runway Factors at the Airport: Delays can also be caused by factors besides the runway. Congestion in the ramp area or on taxiways can keep aircraft from getting to the runway or to the gate in a timely manner. An arrival might find its gate still occupied by an earlier flight, and be delayed waiting for that gate or another to become free. The aircraft at the gate might be delayed on departure if it was late arriving, since a minimum amount of time is still required to unload arriving passengers and baggage, clean the aircraft, and load departing passengers and baggage.

Non-Airport Factors: Lastly, events away from the individual airport can lead to flight delays. En route weather is one example, particularly thunderstorms that close one or more airways. Flights may be held in the air or on the ground as needed to avoid exceeding the capacity of the remaining available airways. Aircraft may also be held on the ground because of congestion at the destination airport, to avoid airborne holding en route or in the terminal area.

Examples of Schedules and Delays

Certainly the airline schedule is one factor affecting delay, but actual delays are the product of many different factors, particularly weather. The same schedule can be in effect on two different days with very different delay results. For example, the airline schedules at ORD on 12 July and 16 July 2004 were essentially identical. However, according to OPSNET data, 23 percent of all operations on 16 July were delayed more than 15 minutes, while only 3 percent were delayed on 12 July.

Figures A-2 and A-3 depict operations on these days, from 7 AM to midnight local time. In each figure, the schedule of operations is shown by a solid line, while actual operations appear as vertical bars. The called arrival rate, the AAR, is also shown as a line.

Clearly, operations on 16 July were affected by a reduction in the AAR between 1:30 PM and 6:30 PM, first to 80 per hour and then to 40 per hour (10 per 15 minute period). This may have been due to thunderstorm activity. A reduction in departures is also apparent.

The largest difference in the schedule for the two days was only three arrivals, and only two departures, over any 15 minute period. However, there were as many as 17 fewer arrivals in a 15-minute period on 16 July (during four different 15-minute periods between 4 PM and 7 PM), and as many as 19 more at 10 PM. Apparently flights were restricted in the afternoon and the backlog lasted until late in the evening. Similarly, there were fewer departures early in the day and more departures after 10 PM.

Airline scheduling practices can lead to delays on the best weather days, as overscheduling can eliminate the ability of the airport to recover from other operational problems. Overscheduling will exacerbate the effect of bad weather, leading to long delays and cancellations. However, it should be kept in mind that the schedule is only one factor affecting delays.

Schedule-Benchmark Charts for Ten Airports

Charts showing airline schedules and capacity benchmarks at ten of the busiest and most delayed airports in the country were prepared for two time periods: January-March 2004 and May-July 2004. Separate charts were prepared for arrivals, departures, and total traffic (arrivals plus departures). These charts appear on the following pages.

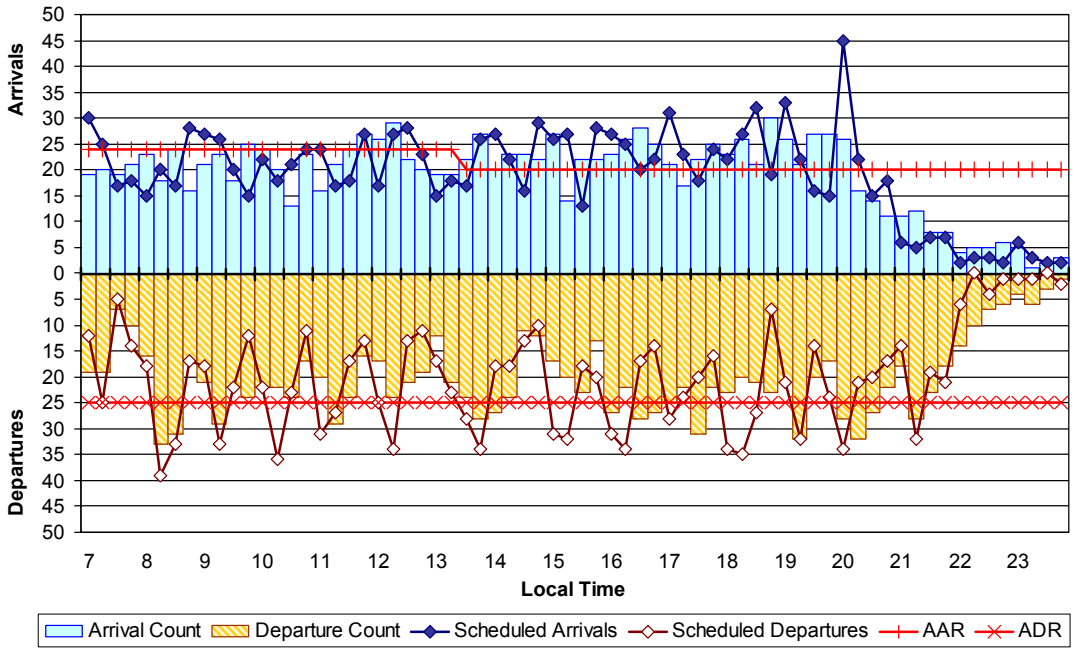


Figure A-2 – 12 July 2004 (Monday) at ORD

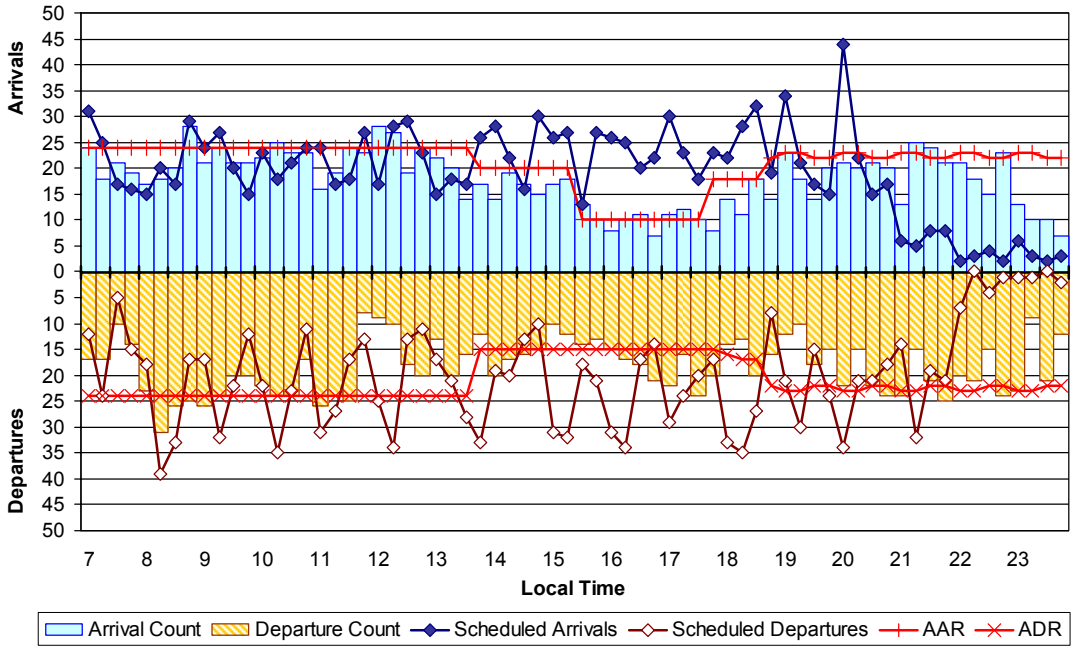
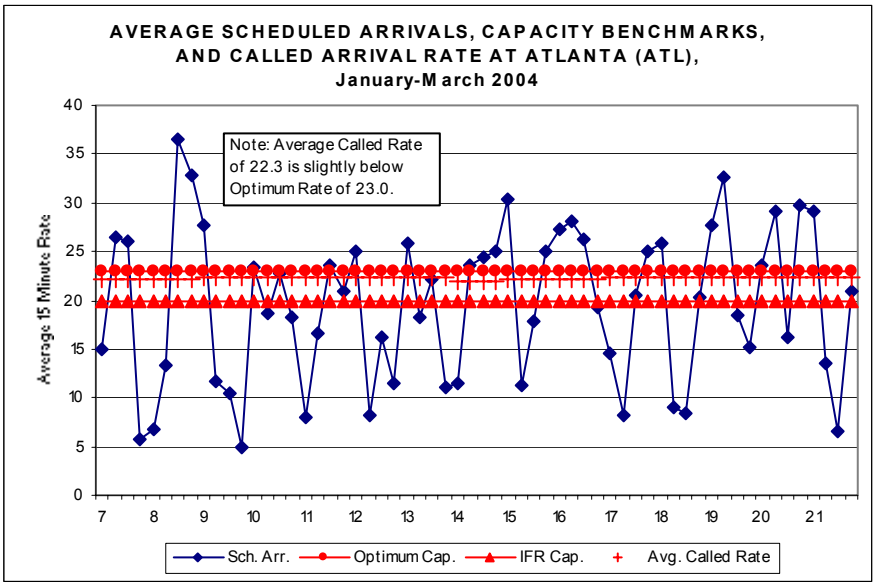
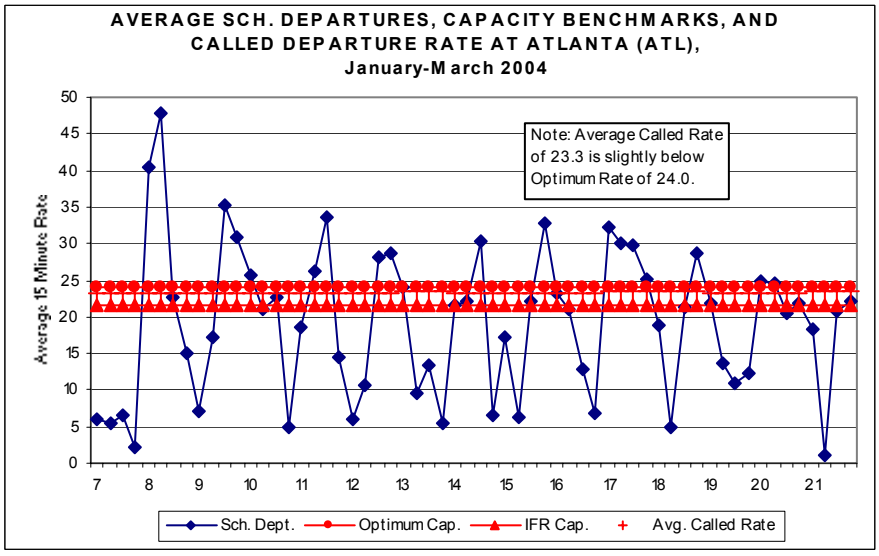


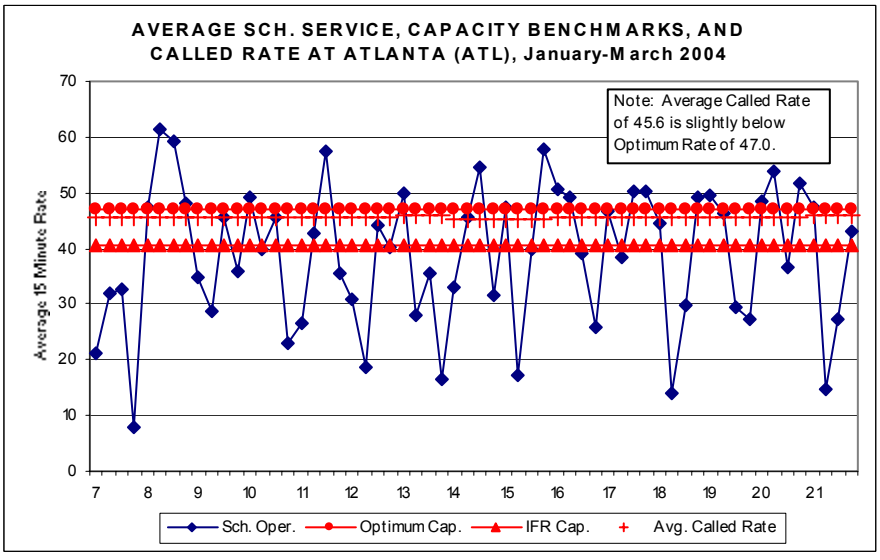
Figure A-3 – 16 July 2004 (Friday) at ORD

Table of Schedule-Benchmark Charts

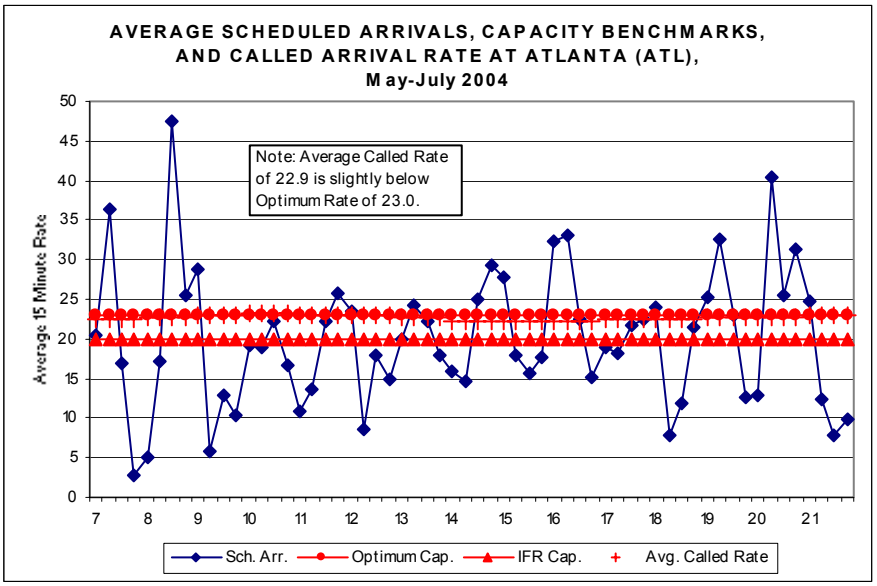
ATL – Hartsfield-Jackson Atlanta International
January-March 2004

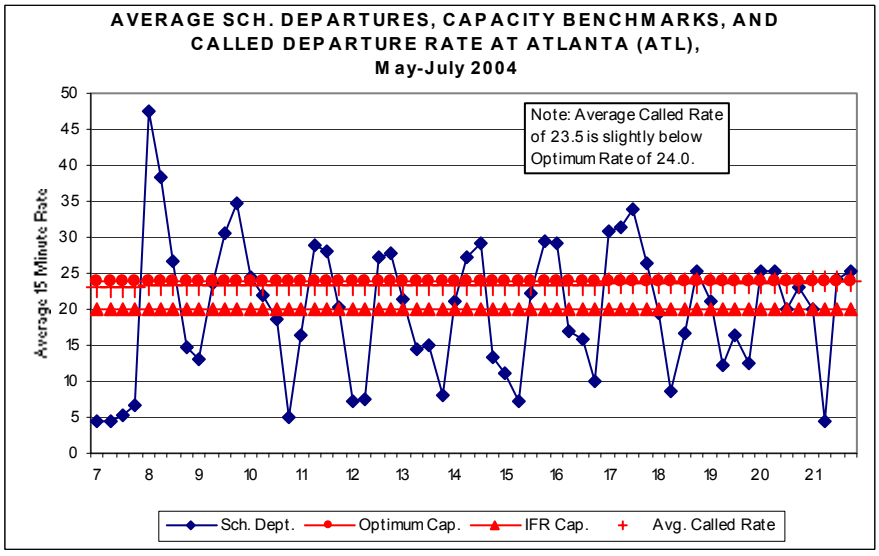


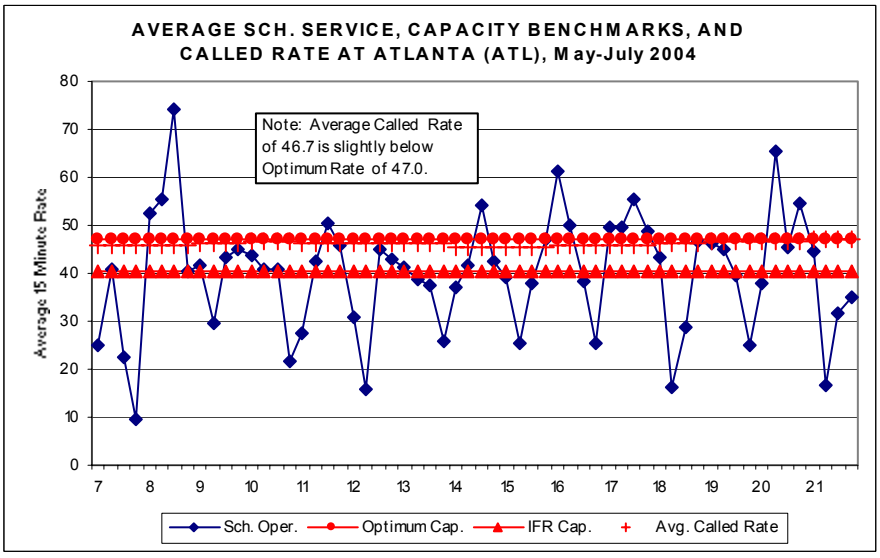




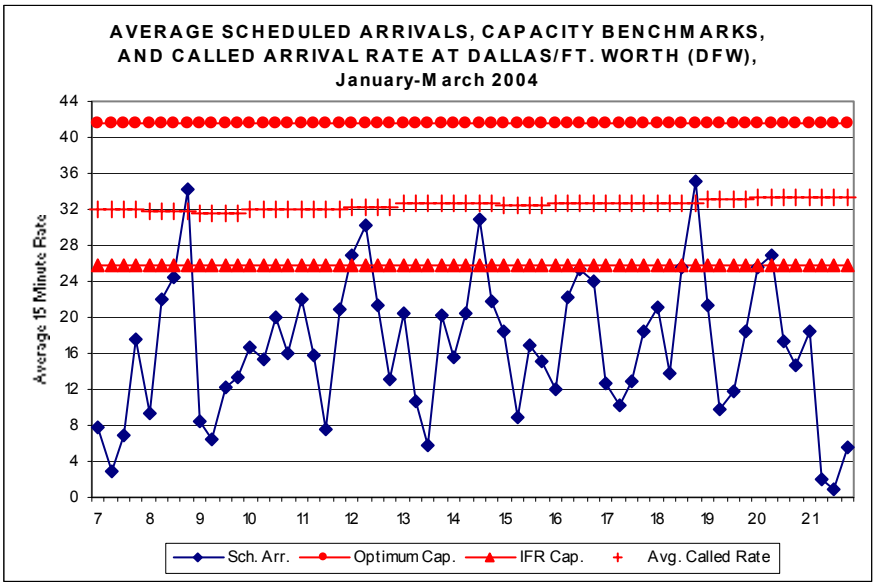
ATL – Hartsfield-Jackson Atlanta International
May-July 2004

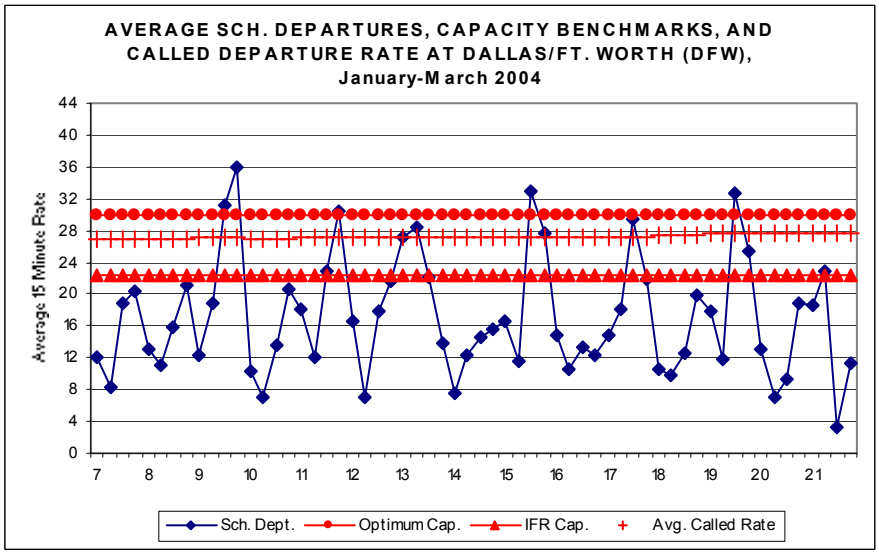


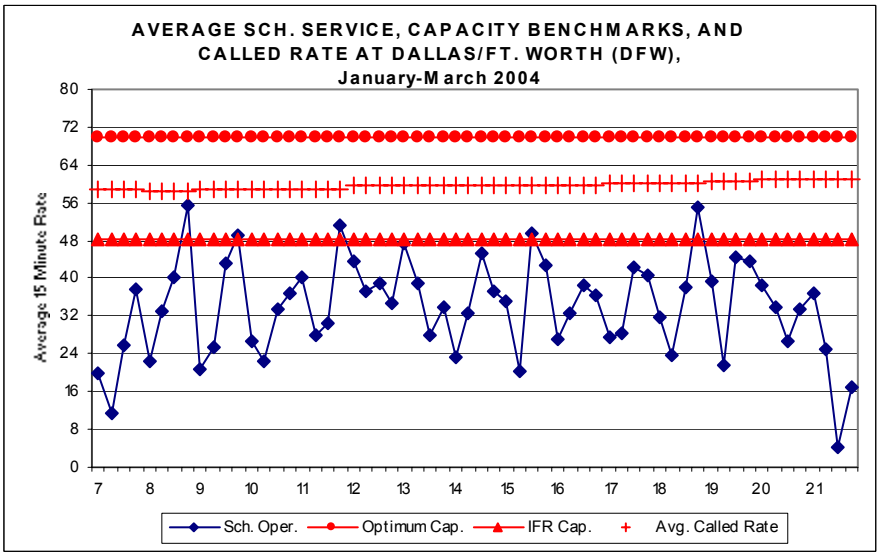




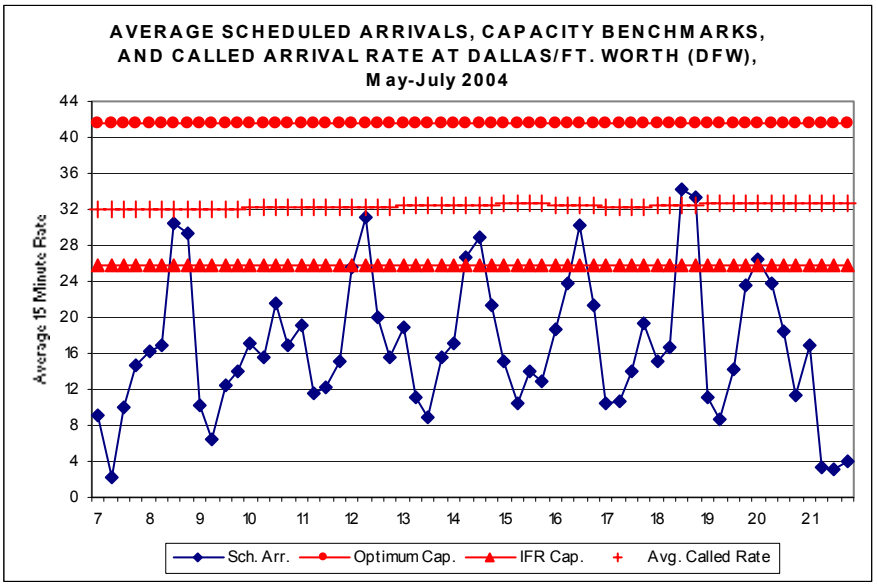
DFW – Dallas/Fort Worth International
January-March 2004

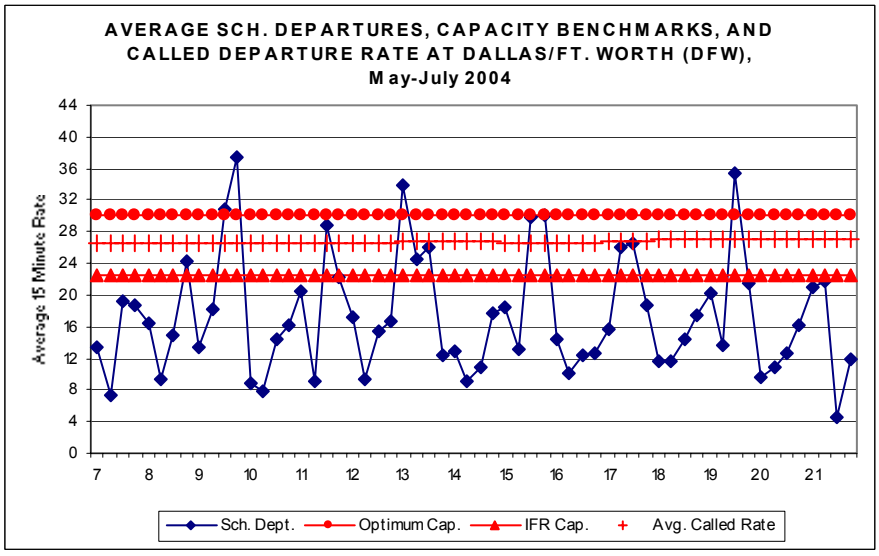


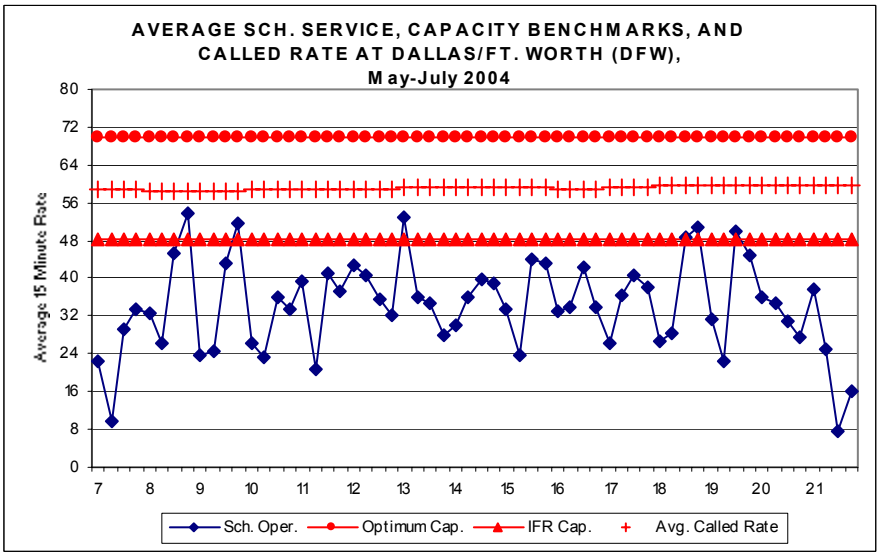




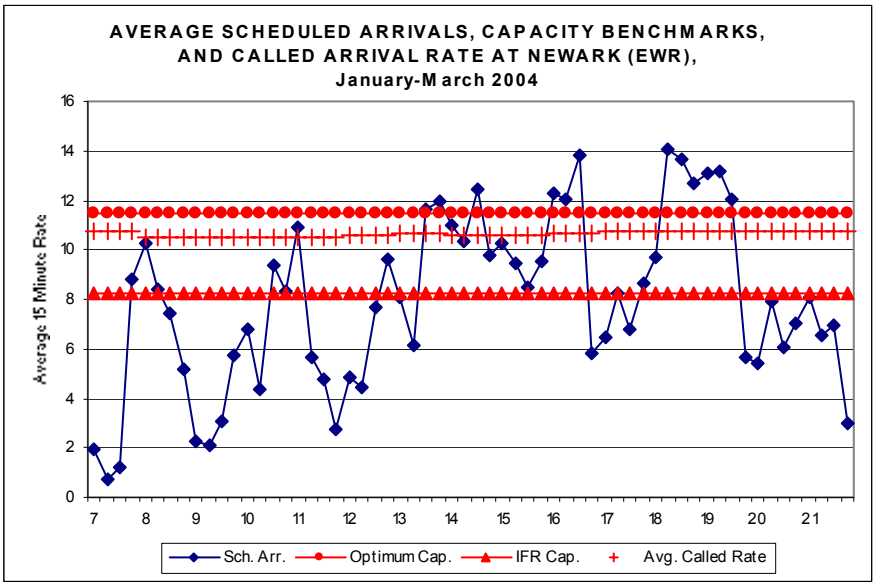
DFW – Dallas/Fort Worth International
May-July 2004

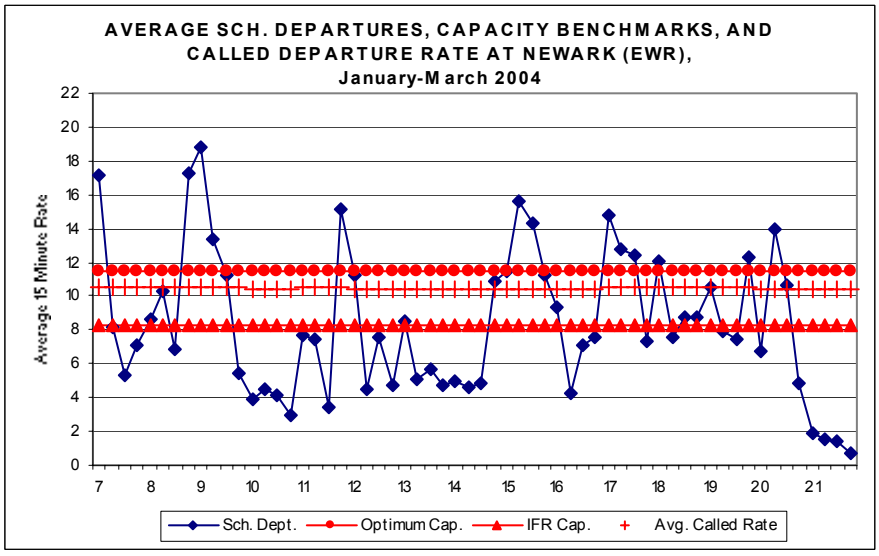


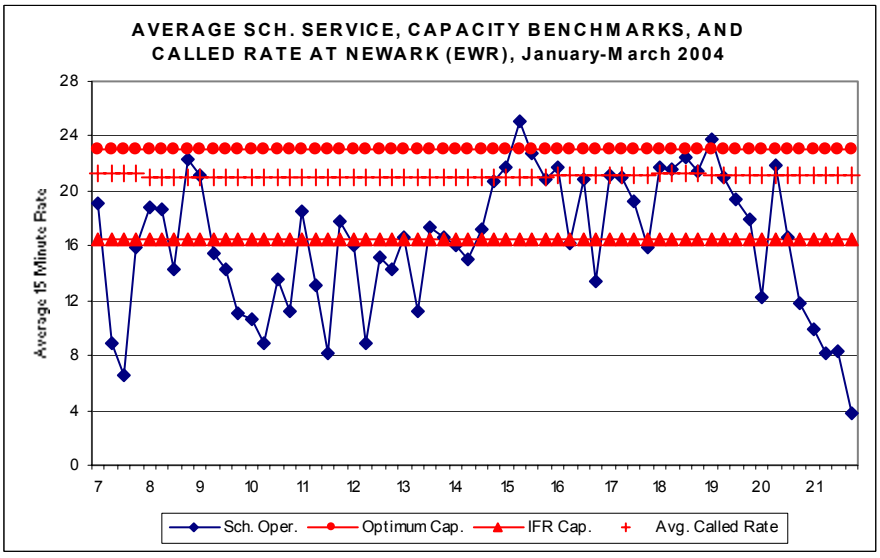




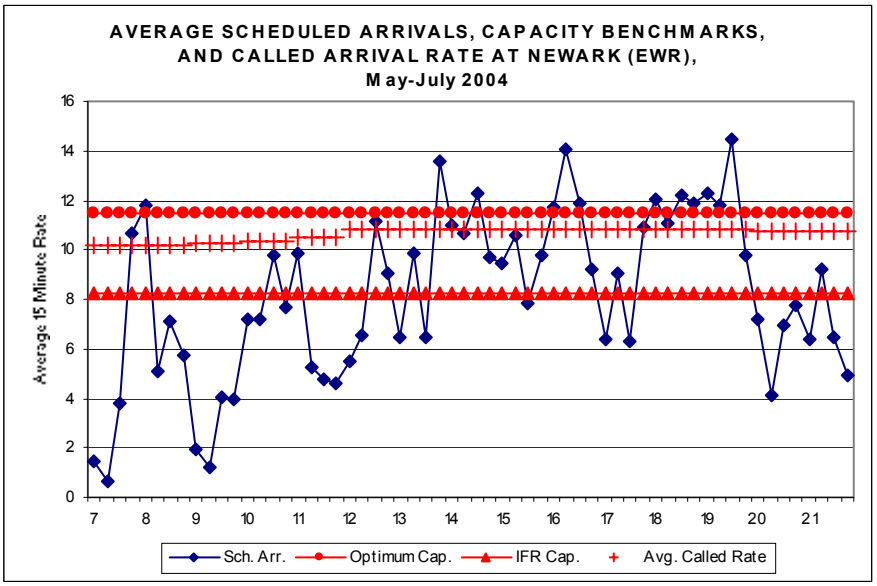
EWR – Newark Liberty International
January-March 2004

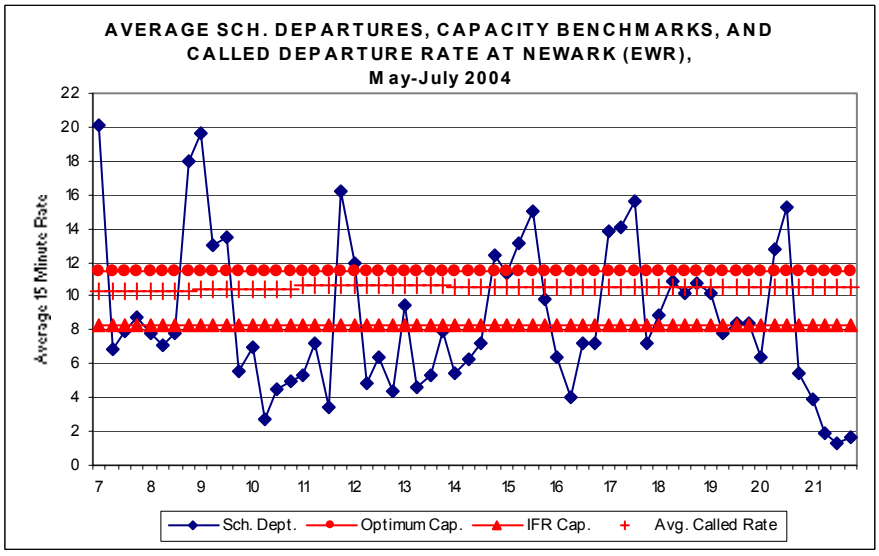


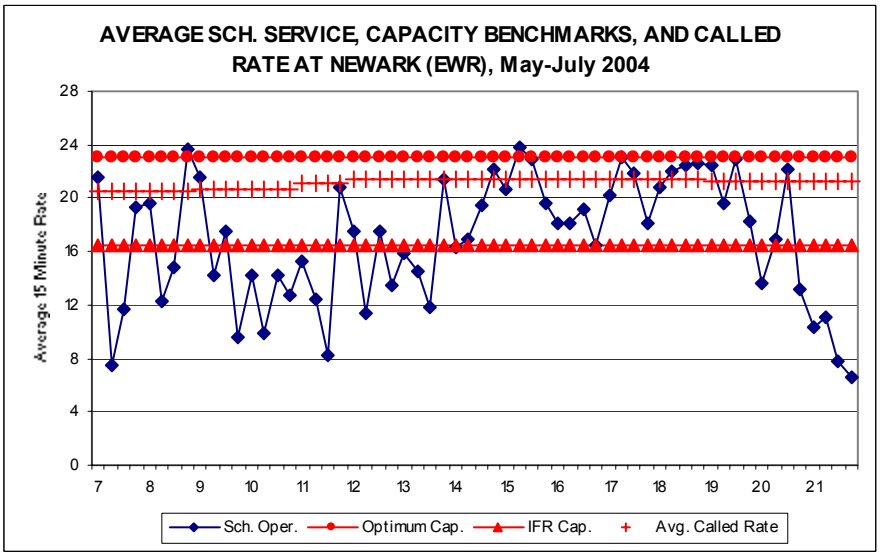




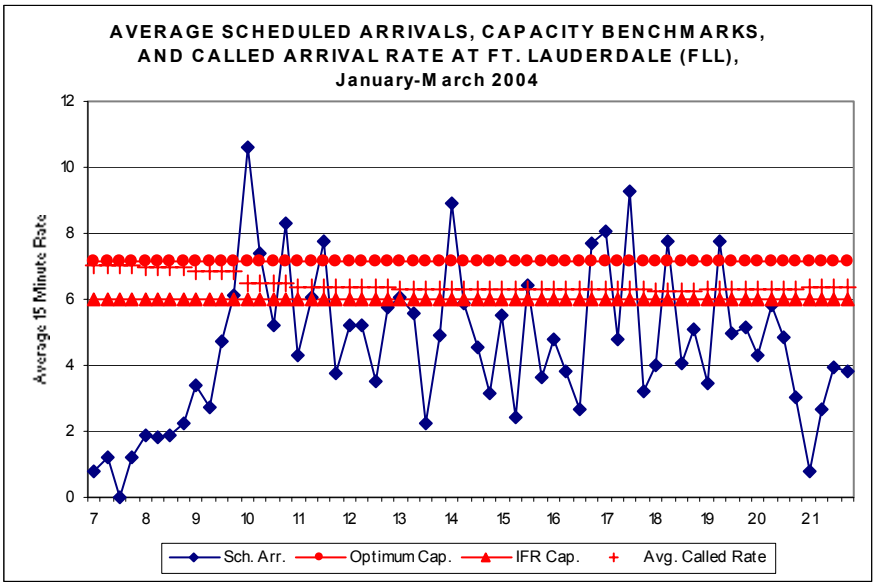
EWR – Newark Liberty International
May-July 2004

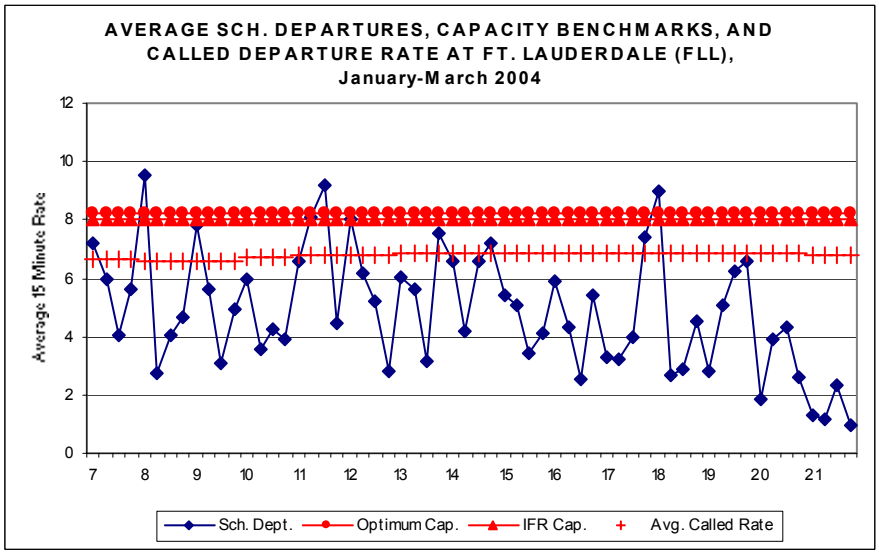


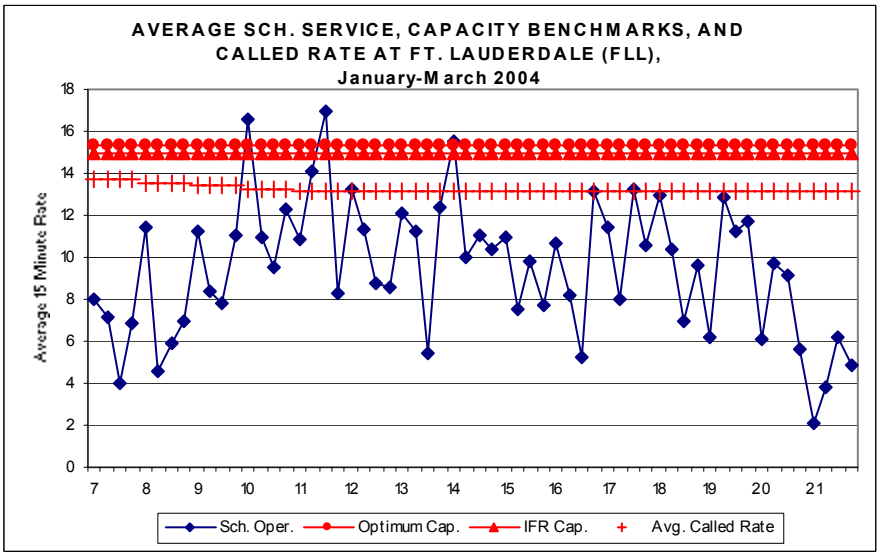




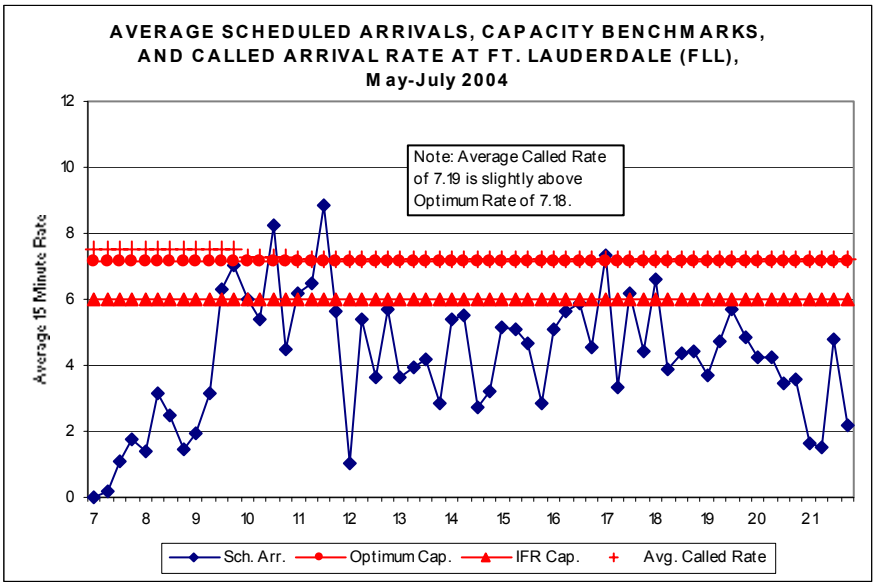
FLL – Ft. Lauderdale-Hollywood International
January-March 2004

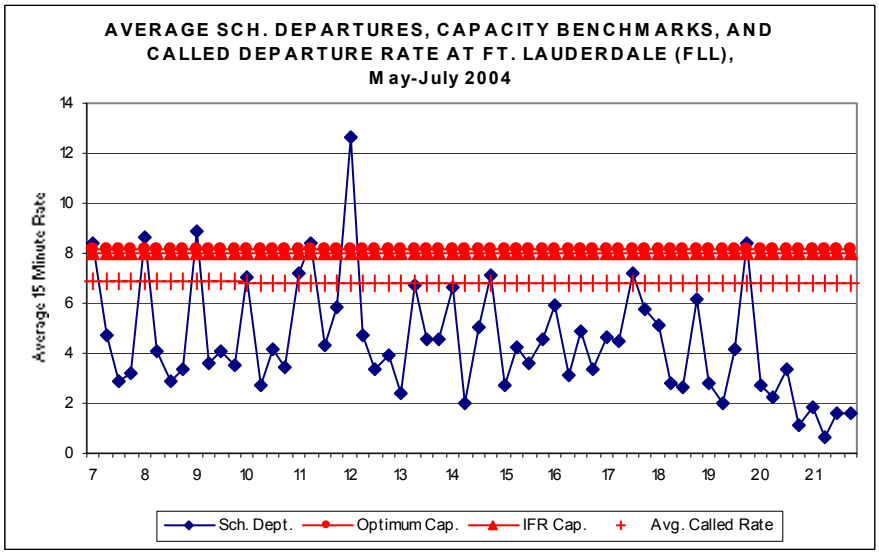


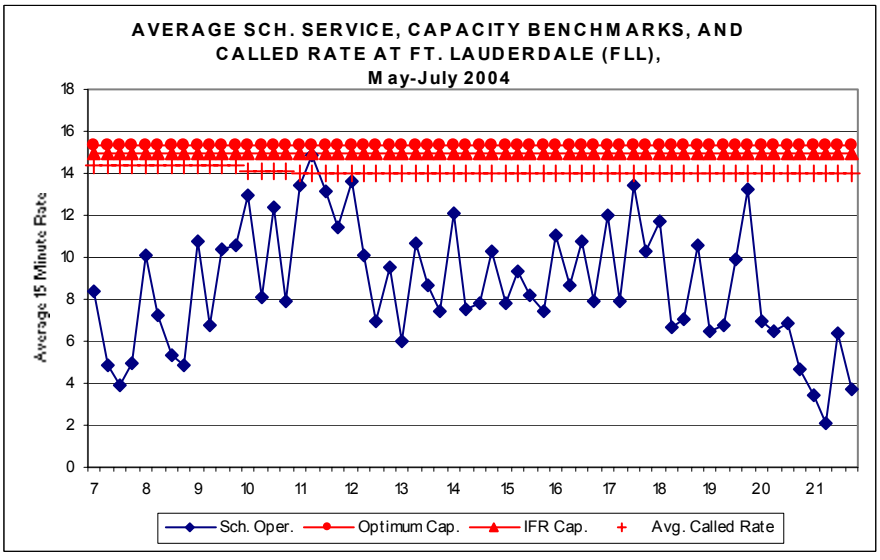




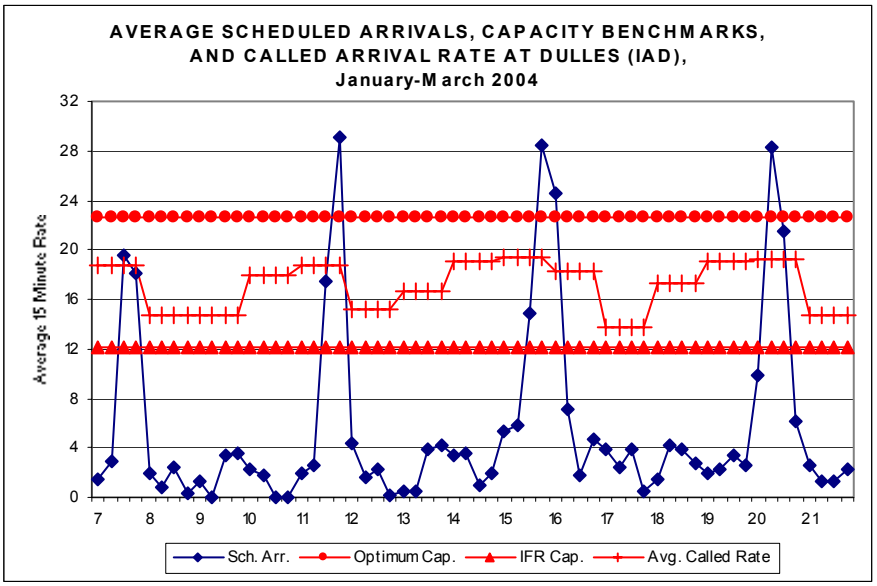
FLL – Ft. Lauderdale-Hollywood International
May-July 2004

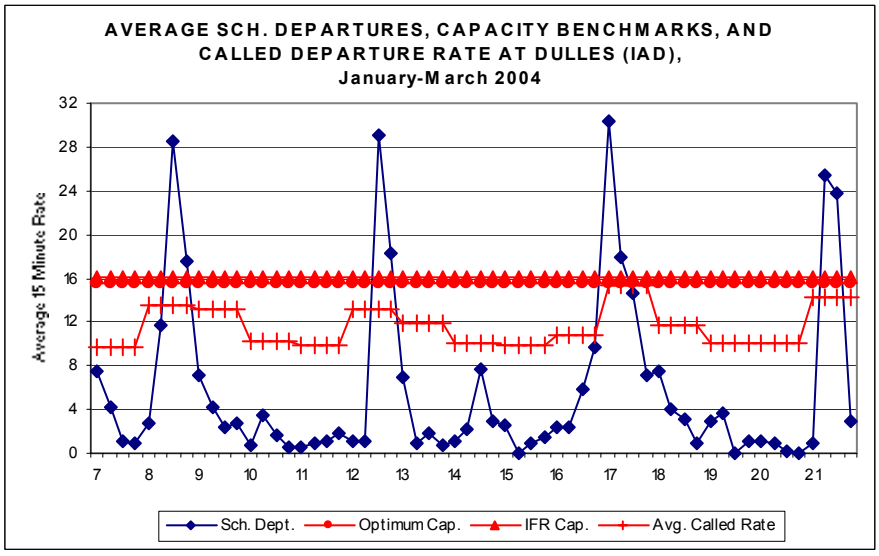


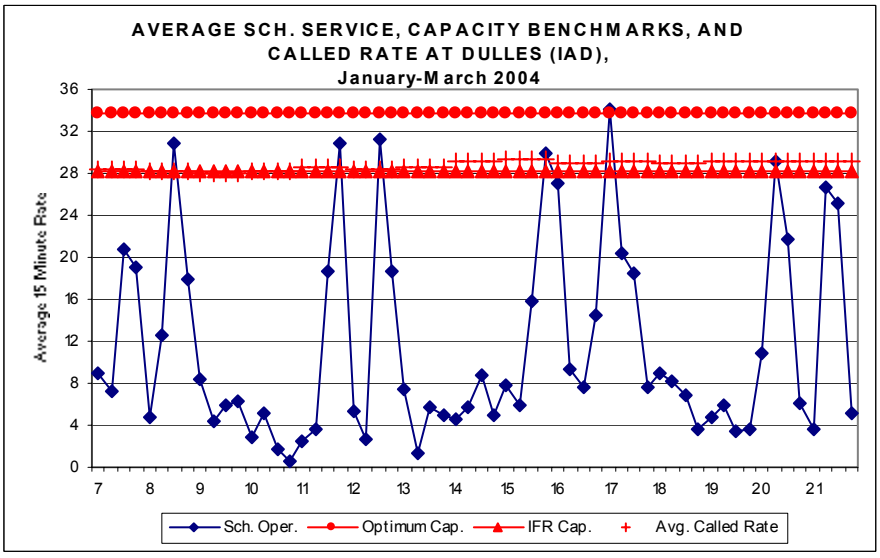




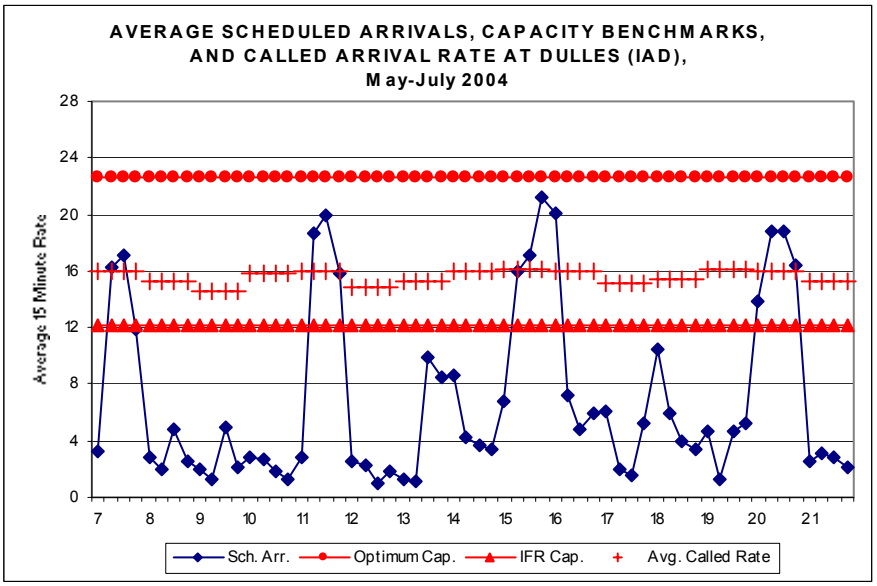
IAD – Washington Dulles International
January-March 2004

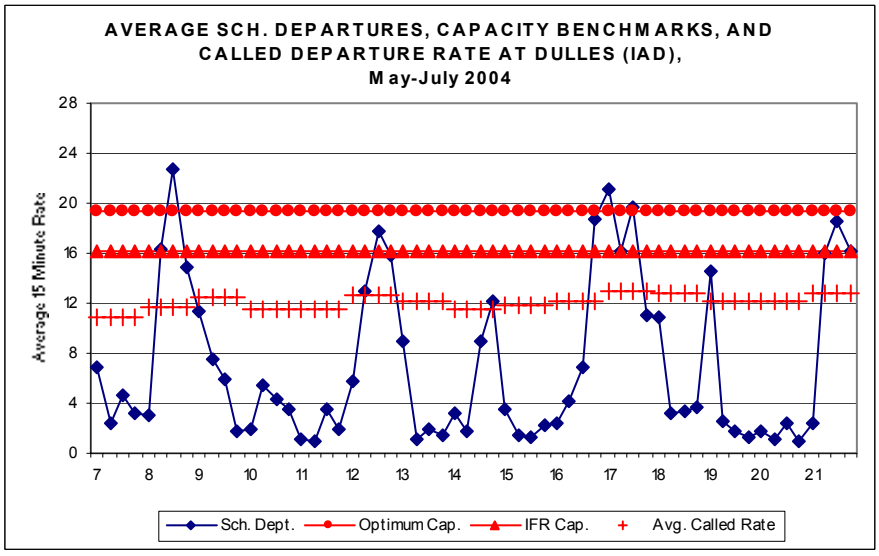


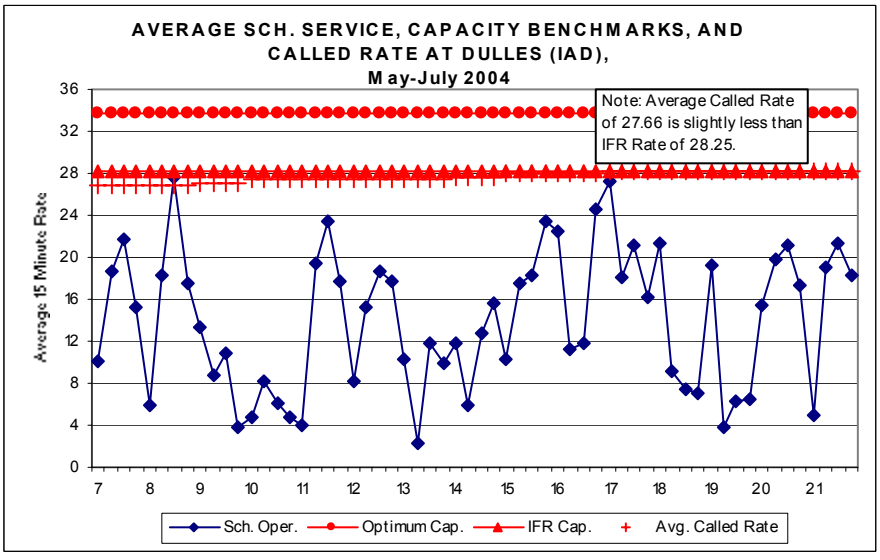




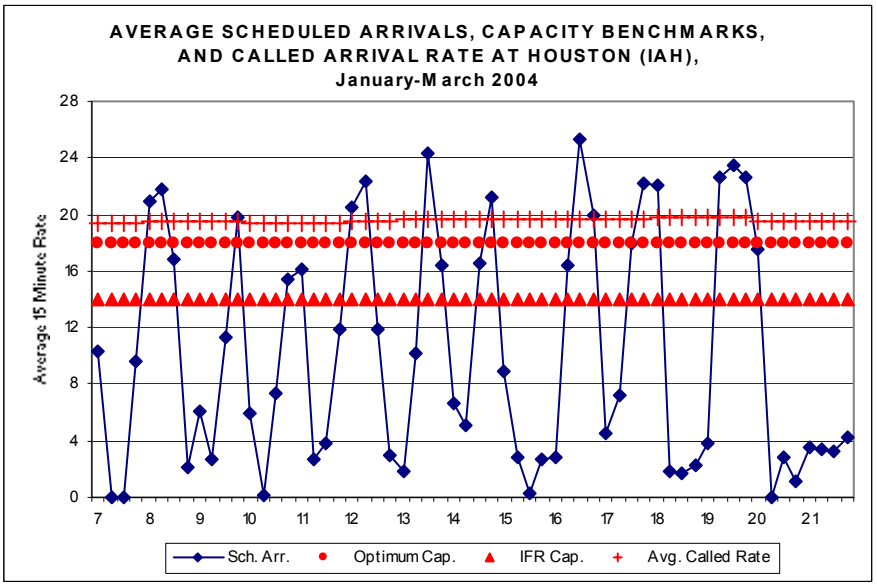
IAD – Washington Dulles International
May-July 2004

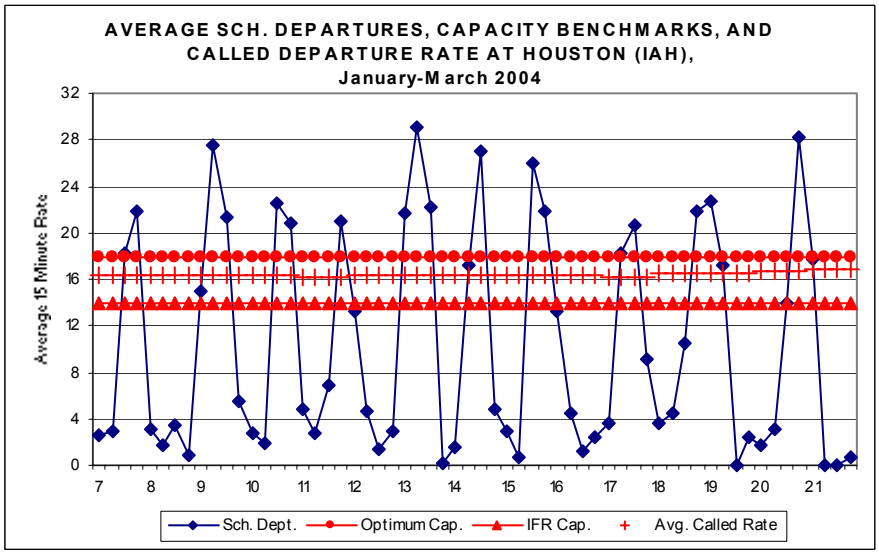


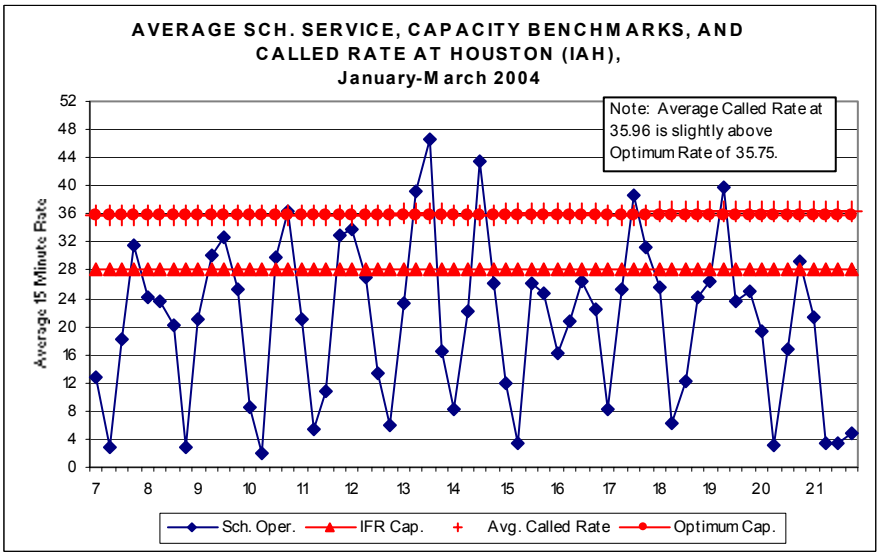




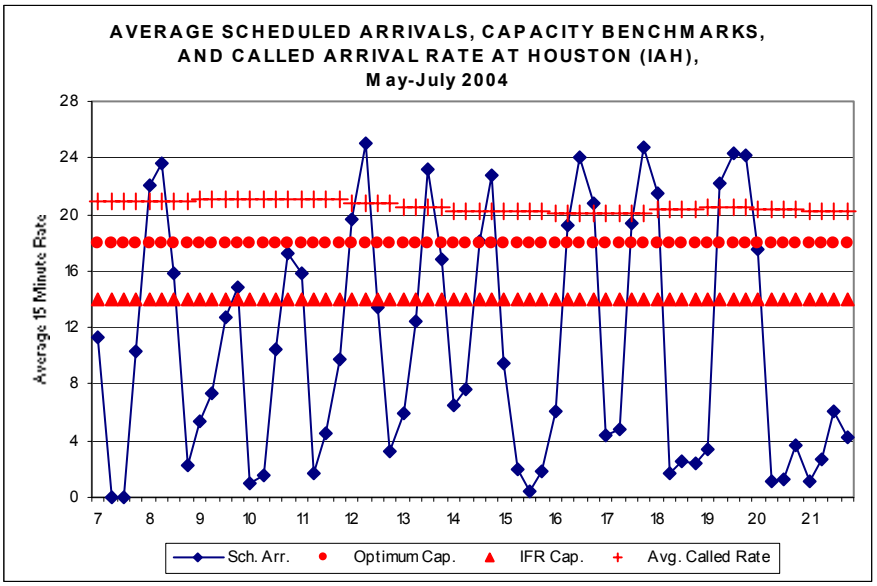
IAH – Houston George Bush Intercontinental
January-March 2004

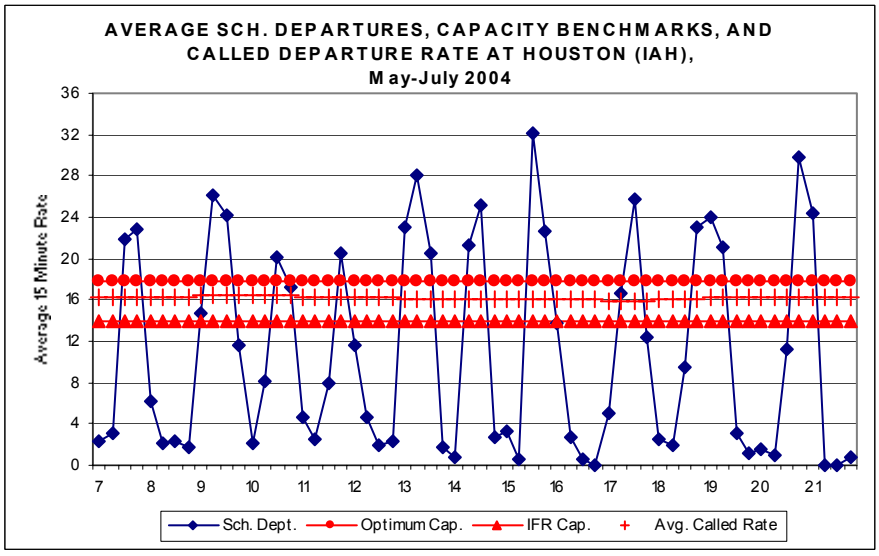


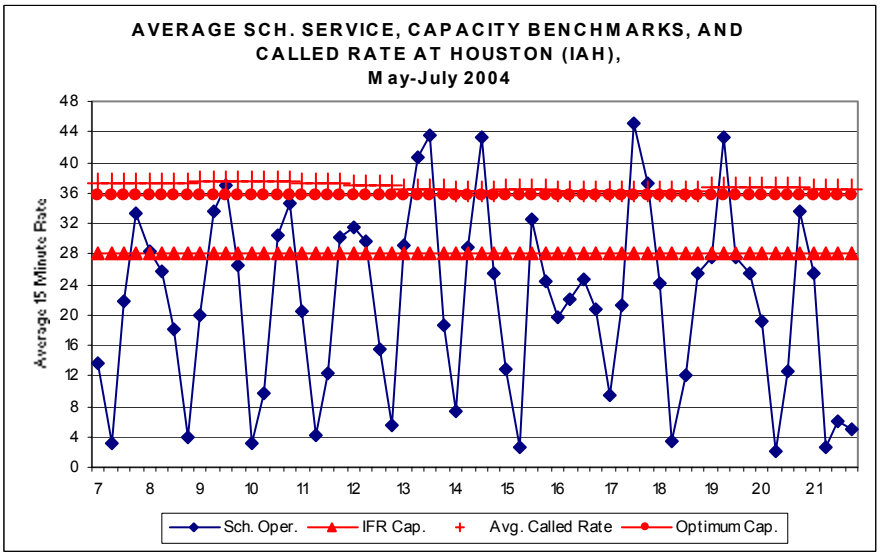




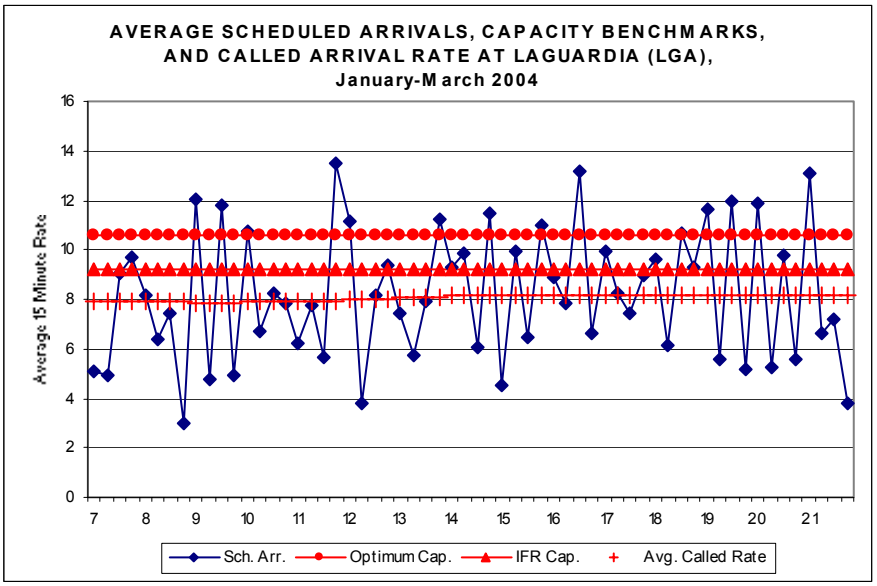
IAH – Houston George Bush Intercontinental
May-July 2004

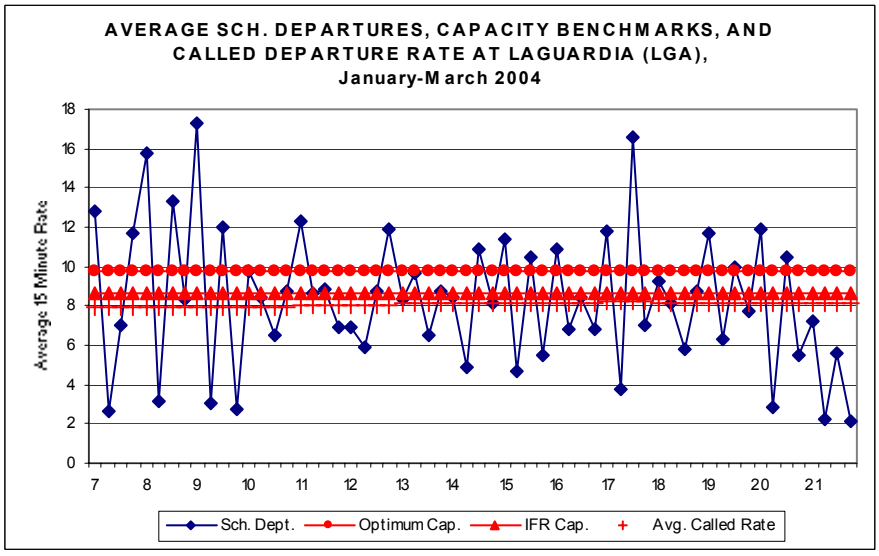


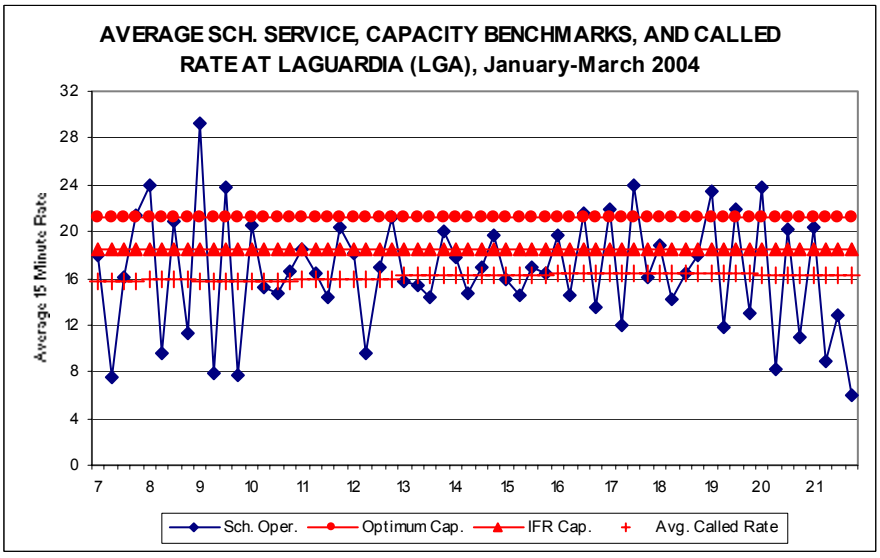




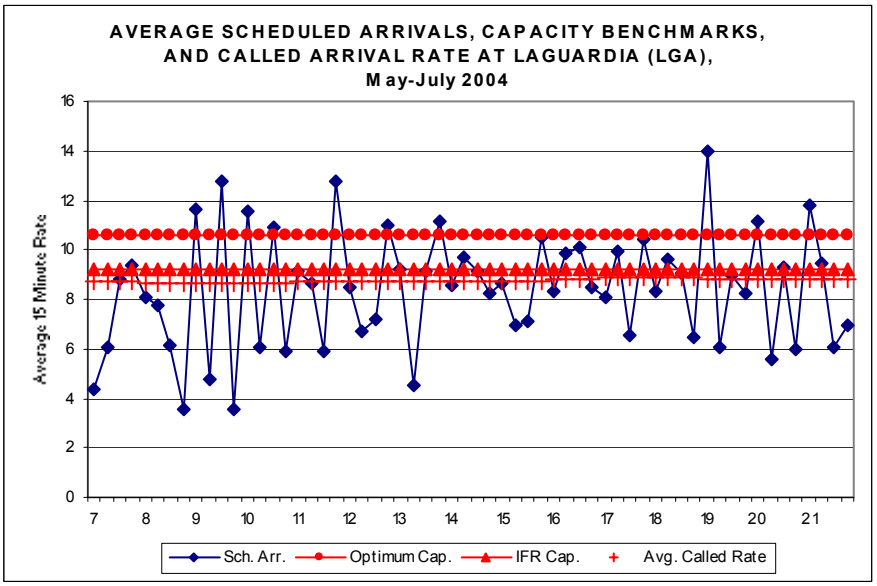
LGA – New York La Guardia
January-March 2004

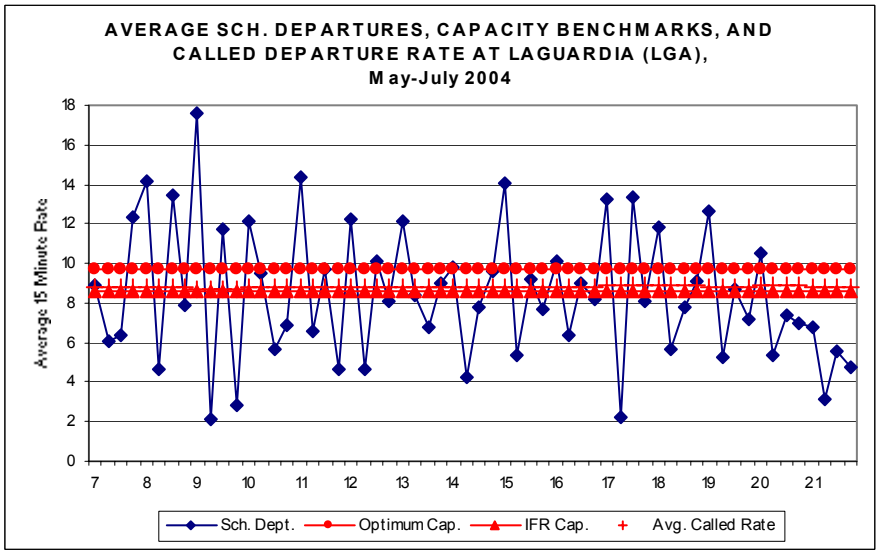


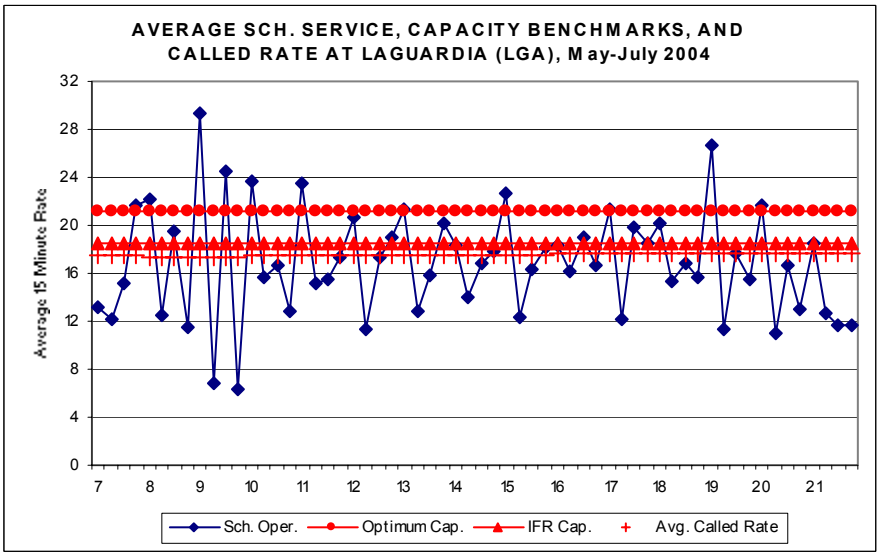




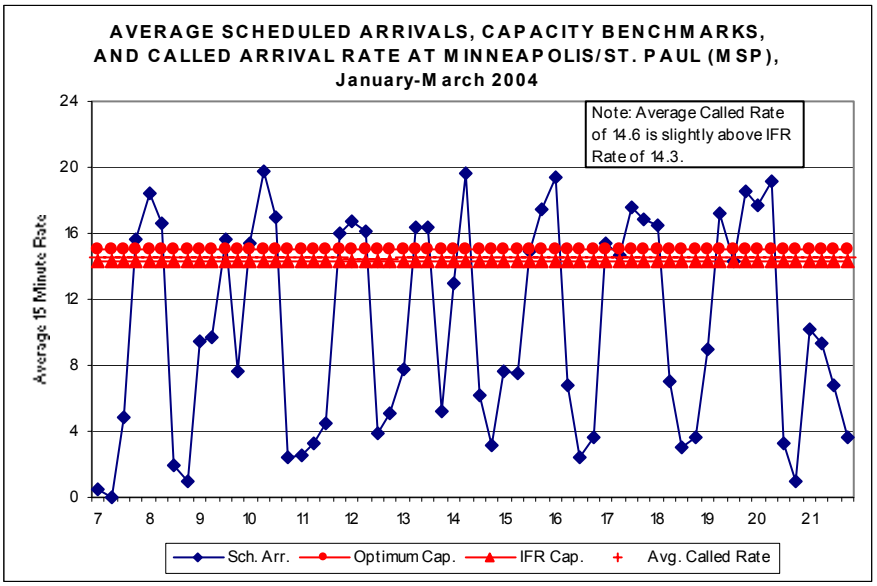
LGA – New York La Guardia
May-July 2004

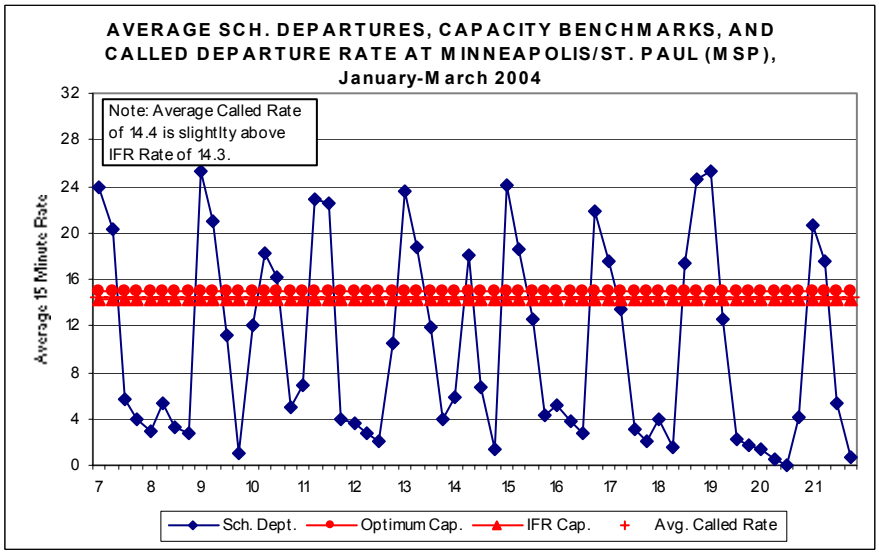


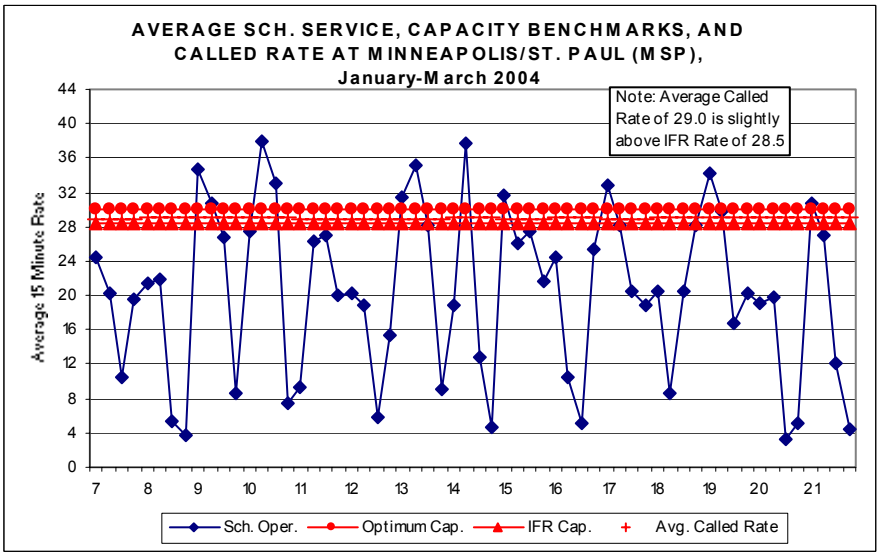




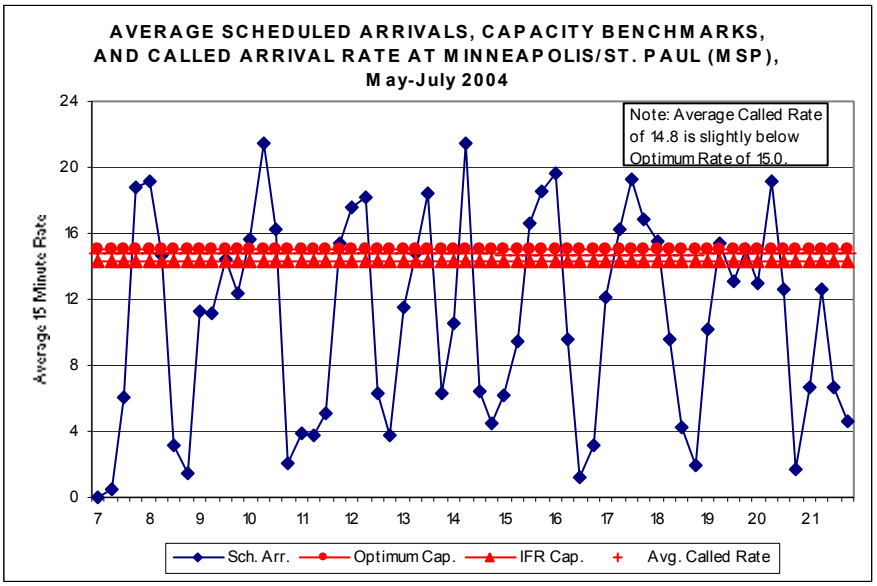
MSP – Minneapolis-St. Paul International
January-March 2004

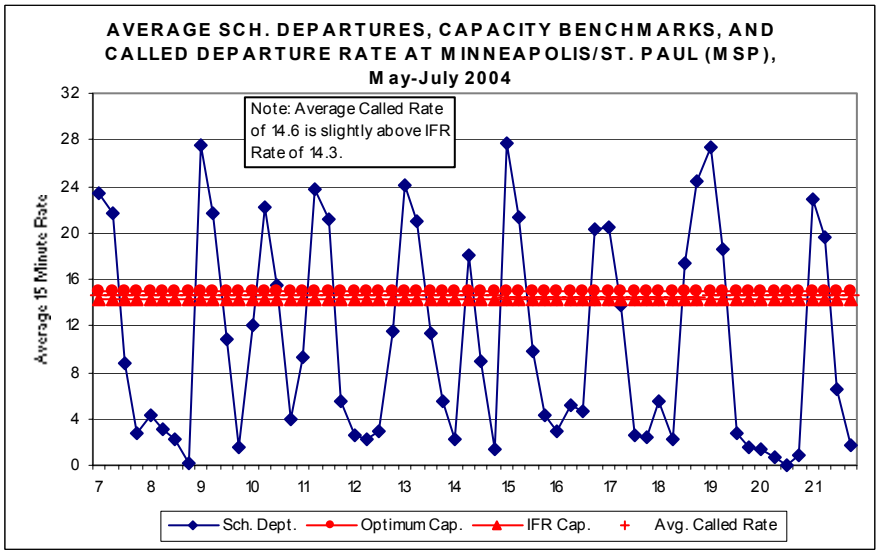


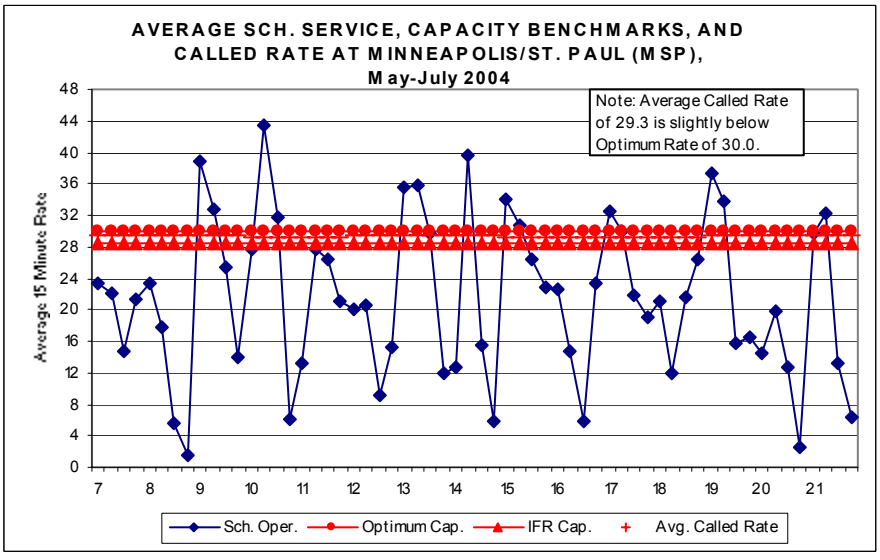




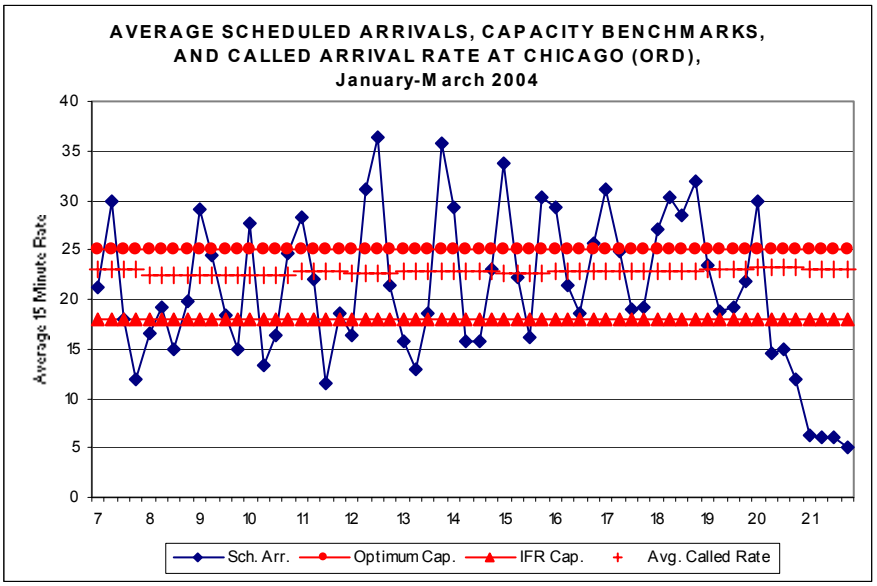
MSP – Minneapolis-St. Paul International
May-July 2004

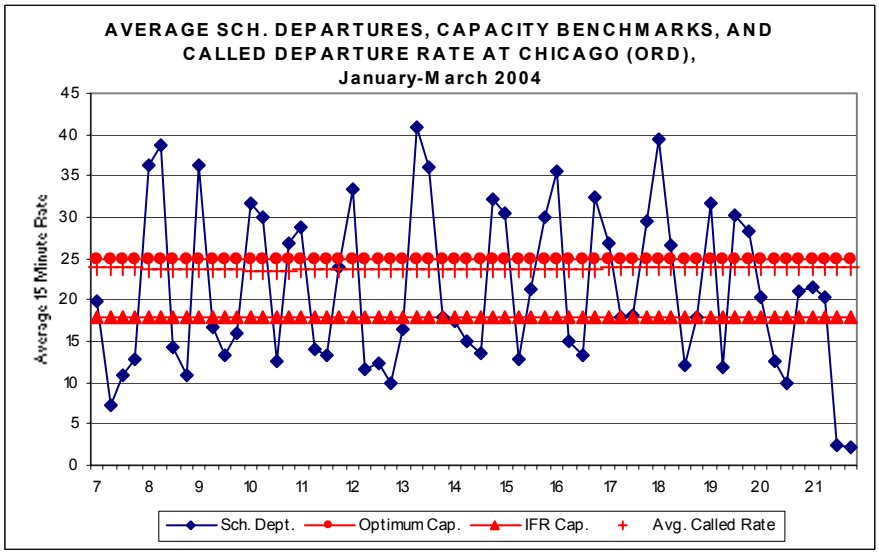


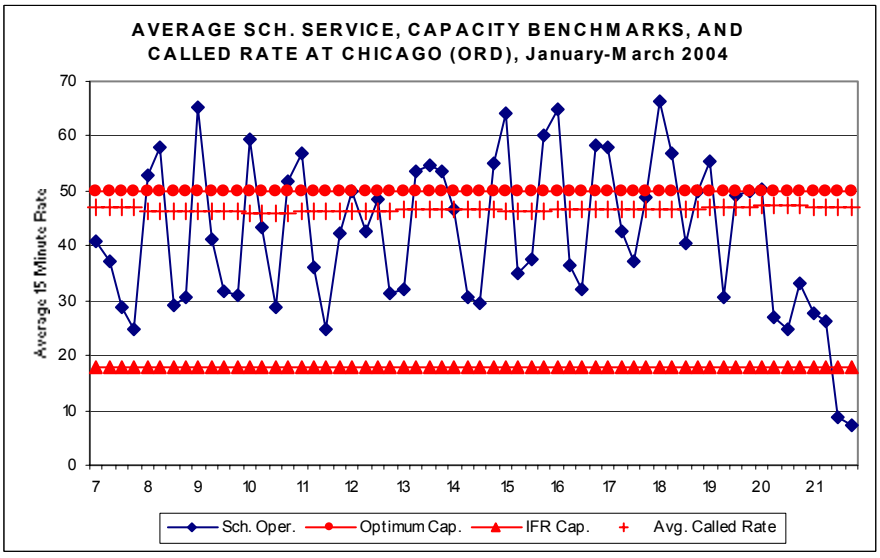




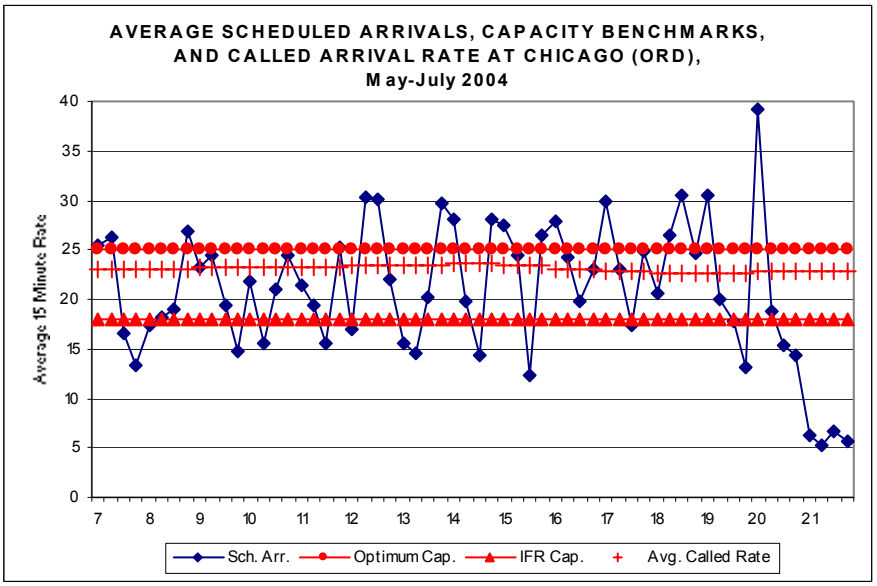
ORD – Chicago O'Hare International
January-March 2004

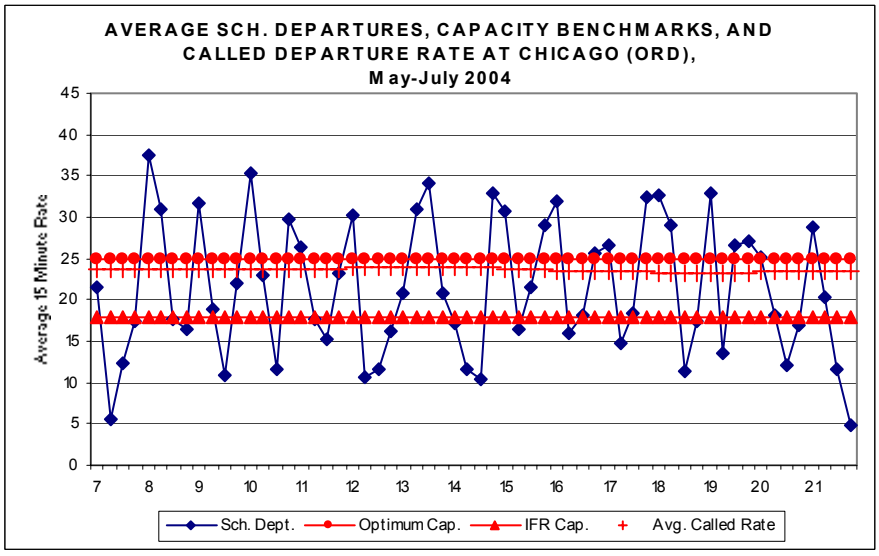


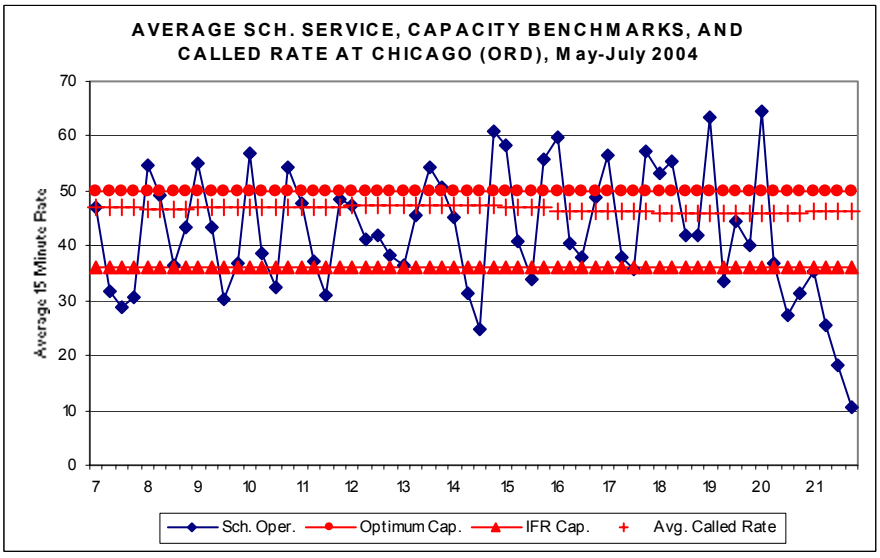




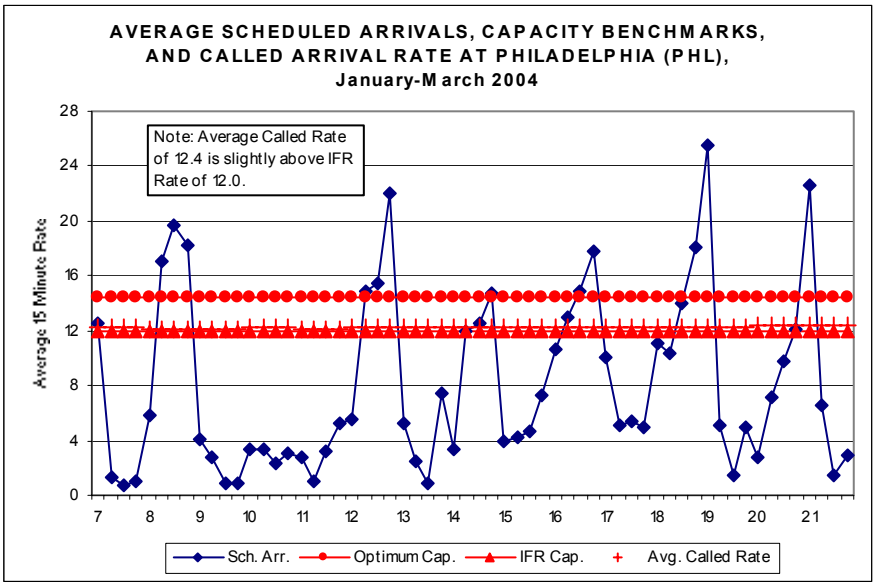
ORD – Chicago O'Hare International
May-July 2004

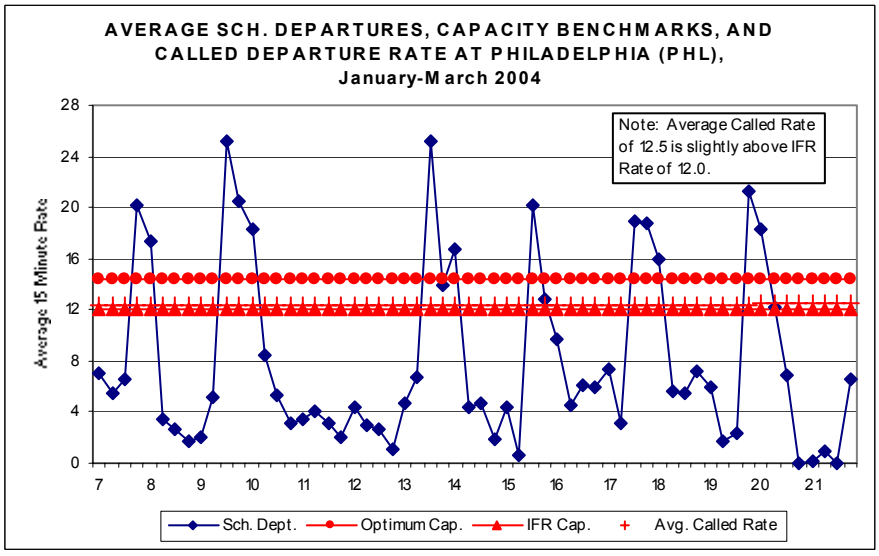


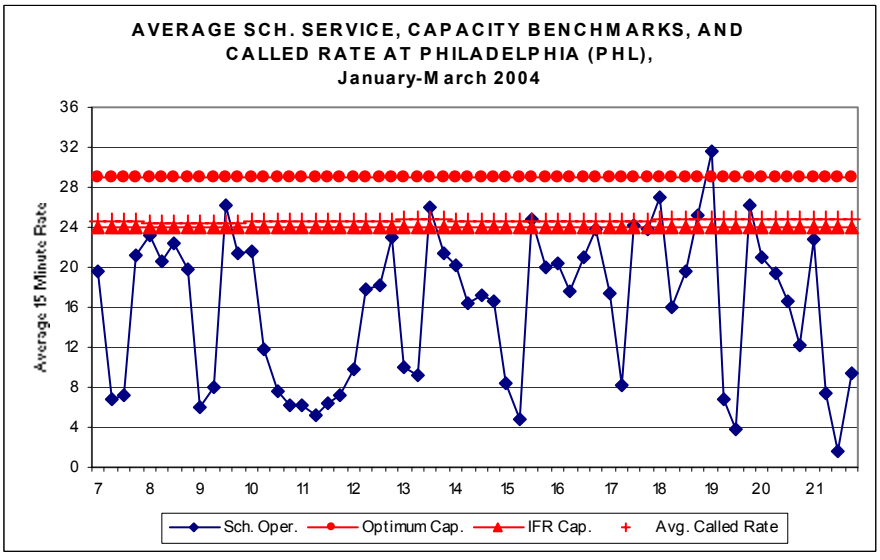




PHL – Philadelphia International
January-March 2004







PHL – Philadelphia International
May-July 2004